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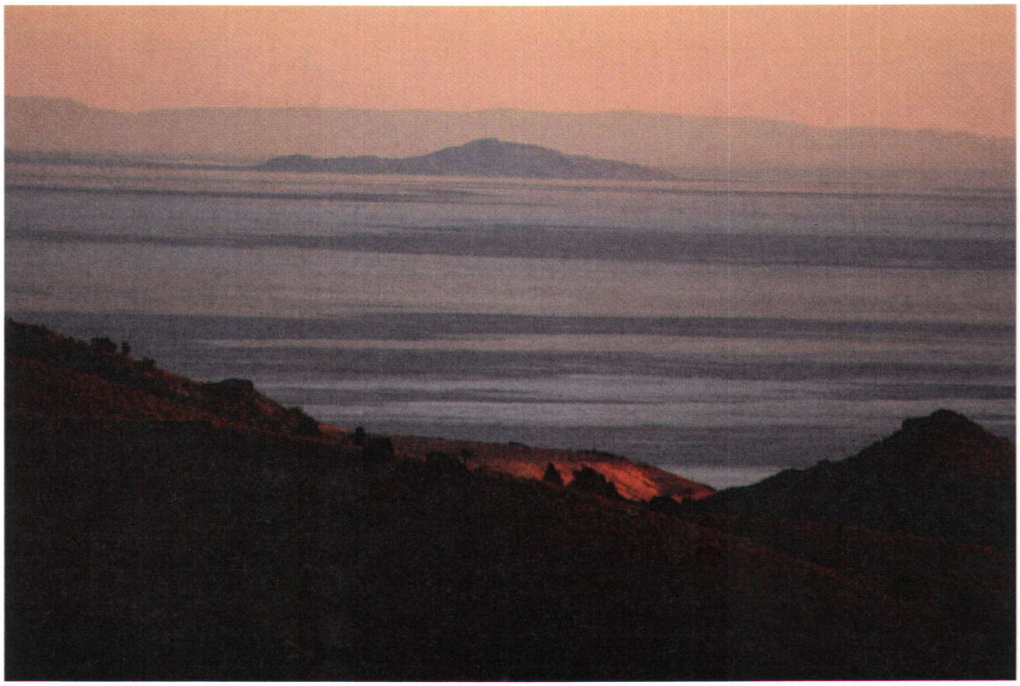
cc: Leslie Lynn

Vegetation Baseline Survey
For the
Gold Hill Region



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Prepared for:
North American Exploration

Prepared by:

WP Natural Resource Consulting, Inc.
PO Box 520604
SLC, UT 84152
(801) 699-5459

Introduction

In September of 2010, a quantitative vegetation survey was conducted for eleven mine sites in the Clifton Mining District near Gold Hill, Toole County, Utah, for North American Exploration. Assessments on undisturbed vegetation are required by the Utah State Division of Oil, Gas and Mining (DOGM) within the immediate area of the mine site to gather quantitative vegetation data for baseline information. This information is generally used for post-mining revegetation targets. The mine operator must reclaim the area to 70% of background vegetation cover in order for the reclamation bond to be released. The site's physical and biological properties described here will help in reaching those revegetation targets.

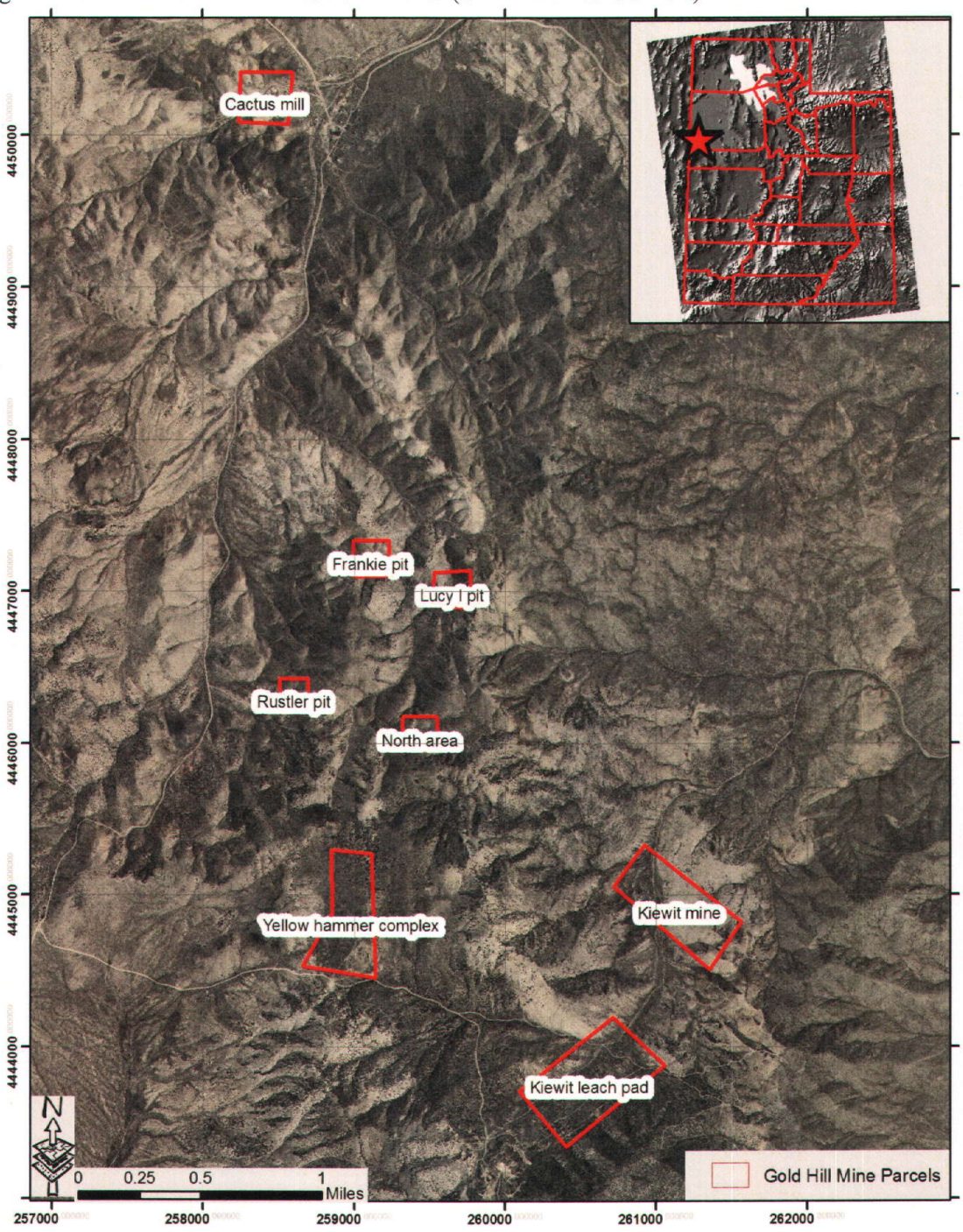
Site Description

The properties are characterized by the typical basin and range geology of the area in that they lie within a north-south trending mountain range surrounded by desert basins and playas with no external drainage. Since the area lies within the rain shadow of the Sierra and Cascade ranges to the west, the area is arid receiving an average of only 10 inches of precipitation each year. Approximately half of the precipitation comes as snow between February and May, and the other half generally arrives as rain showers or occasional severe thunderstorms.

The mine sites are located in the foothills north of the Deep Creek Mountains in Toole County, Utah within Township and Ranges- T8S R18W and T8S R17 W, and within a 4.8 mile radius of Gold Hill. (See Figure 1 – Site Map)
The properties surveyed and their general locations and elevations are:
Cactus Mill- 40°10'05"N 113°50'11"W, Elevation 5318 feet
Frankie Pit- 40°08'26"N 113°49'42"W, Elevation 6086 feet
Lucy L. Pit- 40°08'22"N 113°49'18"W, Elevation 6043 feet
Rustler Pit- 40°07'57"N 113°49'57"W, Elevation 6129 feet
North Area- 40°07'49"N 113°49'26"W, Elevation 6250 feet
Yellow Hammer A, B, C and West Zones- clustered around 40°07'11"N 113°49'37"W, Elevation 6293 feet
Kiewit Mine- 40°06'56"N 113°48'07"W, Elevation 5866 feet
Kiewit Leach Pad- 40°06'42"N 113°48'29"W, Elevation 5899 feet

The area is dominated by three principal vegetation types – black sagebrush (*Artemisia nova*), Wyoming sagebrush (*Artemisia tridentata var. wyomingensis*), and pinyon/juniper (*Pinus monophylla/Juniperus osteosperma*) woodlands. Detailed descriptions of these vegetation types are found in the Vegetation section of this report.

Figure 1. General location of the Gold Hill area (UTM NAD 83 CONUS)



Methods

A total of thirty-five – 100 foot point line transects were recorded within the three major vegetation types of the area, which are pinyon/juniper woodlands, Wyoming sagebrush shrublands, and black sagebrush shrublands. After a representative site was reached, a pin was spun to generate a random azimuth of the transect. At each transect, a pin was lowered at one foot intervals and all plant species or other ground cover (liter, rock, gravel, bare ground) the pin intercepted were recorded. If the pin intercepted more than one stratum of vegetation, these were noted as 'second' and 'third' hits. This information was then statistically analyzed as a percent cover and relative cover per species and per life form (Tables 1, 2 and 3). The '<1' in these tables indicates that a species was present in a 6 foot wide belt transect centered around the transect, but was not intercepted by the pin. Ten transects within the pinyon/juniper community were analyzed, 13 transects for the Wyoming sagebrush community were analyzed and 12 transects for the black sagebrush community.

Vegetation Communities

The flora of the area falls within the Bonneville Basin Section of the Great Basin Floristic Division (Intermountain Flora, Cronquist et. al.). The vegetation includes mosaics of singleleaf pinyon/Utah juniper, black sagebrush, and Wyoming big sagebrush community types with minor areas of rubber rabbitbrush (*Chrysothamnus nauseosus*), Basin big sagebrush (*Artemisia tridentata* var *tridentata*) and greasewood (*Sarcobatus vermiculatus*) dominated zones within the three major community types. Sagebrush (*Artemisia spp*) is dominant over much of the cold desert shrub lands of the Great Basin and is the most common community type within the study area (See site maps in Appendix A)

Black Sagebrush community: Black sagebrush covers over 40% of the acreage mapped. Black sage is generally found on shallow soils in valleys and on exposed mountain slopes. Total vegetation cover in this community averaged 35.9% +/- 7.7%. Ground cover was predominantly gravel or bare ground (22.8% and 23.4% respectively), rock was 13.1% and litter was only 7.8%. (See Table 1).

Black sagebrush was the clear dominant in this community type and accounted for almost half (44%) of the vegetation cover. Other significant shrubs in this vegetation type included Wyoming big sagebrush (3.9% relative cover), viscid rabbitbrush (*Chrysothamnus viscidiflorus*) (5.3% relative cover), littleleaf horsebrush (*Tetradymia glabrata*) (5.8% relative cover) and hopsage (*Grayia spinosa*) with 3.7% relative cover (See Figures 1 and 2).

All grass species combined was 18.8% of the total vegetation cover. Major cool season perennial grass components included Sandberg's bluegrass (*Poa secunda*) (9.5% relative cover), Indian Ricegrass (*Stipa hymenoides*) at 4.6% relative cover and bottlebrush squirreltail (*Elymus elymoides*) at 2.8% relative cover. All life classes of forbs (perennials, annuals, biennials) contributed only 1.6% of the vegetation cover. The paucity of grasses and forbs may be due to a combination of physical constraints (precipitation, poor soils, etc) and livestock grazing history. Livestock grazing can selectively remove and/or hinder grass and forb growth and regeneration. Soils supporting black sagebrush in this area are typically shallow and xeric, thus have a lower water holding capacity than adjacent sites that tend to be dominated by Wyoming big sagebrush or Basin big sagebrush. In addition, the soils in this community type have more surface rock and gravel (35.9% compared with 17.6% for Wyoming big sagebrush). Black sagebrush is sometimes found in more deep and moist soils and may co-

dominate with larger sagebrush subspecies. As such, black sagebrush is often found within Wyoming big sagebrush and pinyon/juniper communities in the study area.
(See soil and vegetation maps in Appendix A)

Figure 2. View from ridge at Lucy I Pit looking north west. Black sagebrush communities on near and far slopes, pinyon/juniper communities at mid slopes and ridges in distance

Figure 3. View looking south east at Rustler Pit. Black sagebrush community in the foreground with hopsage and green ephedra.

Table 1. Black sagebrush community type

	Black sagebrush Gold Hill n=12								
	Scientific Name	Common Name	Avg	St Dev	St Error	Low	High	Rel Cover	Frequenc
Total Vegetation Cover			35.9	7.7	2.2	28.0	55.0		
Litter			7.8	3.6	1.1	3.0	15.0		
Rock			13.1	6.5	2.2	5.0	25.0		
Gravel			22.8	8.7	2.6	7.0	35.0		
Total Ground Cover			77.0	9.1	2.6	57.0	89.0		
Bare Soil			23.4	9.5	2.7	11.0	43.0		
Cool season perennial grasses									
	Elymus elymoides	Bottlebrush Squirreltail	1.0	1.5	0.4	0.0	4.0	2.8	58.3
	Elymus spicatus	Bluebunch Wheatgrass	0.3	0.6	0.2	0.0	2.0	0.7	33.3
	Other cool season perennial grasses		0.3	0.7	0.2	0.0	2.0	0.9	33.3
	Poa secunda	Sandberg Bluegrass	3.4	3.6	1.0	0.0	12.0	9.5	75.0
	Stipa hymenoides	Indian Ricegrass	1.7	2.4	0.7	0.0	10.0	4.6	75.0
	Stipa comata	Needle-and-thread Grass	0.1	0.3	0.1	0.0	1.0	0.2	33.3
		Sub-total	**6.7**	**5.3**	**1.5**	**1.0**	**12.0**	**18.8**	
Warm season perennial grasses									
	Hilaria jamesii	Galleta	0.4	0.9	0.3	0.0	3.0	1.2	25.0
		Sub-total	**0.4**	**0.9**	**0.3**	**0.0**	**3.0**	**1.2**	
Annual grasses									
	Bromus tectorum	Cheatgrass	0.6	1.0	0.3	0.0	5.0	1.6	66.7
		Sub-total	**0.6**	**1.0**	**0.3**	**0.0**	**5.0**	**1.6**	
Perennial forbs									
	Astragalus beckwihii	Beckwith's milkvetch	0.1	0.3	0.1	0.0	1.0	0.2	16.7
	Astragalus spp	Milkvetch	0.1	0.3	0.1	0.0	1.0	0.2	8.3
	Astragalus utahensis	Utah lady finger	<1	<1	<1	<1	<1	<1	8.3
	Boechera sp	Rockcress	<1	<1	<1	<1	<1	<1	25.0
	Castilleja sp	Paintbrush	<1	<1	<1	<1	<1	<1	8.3
	Caulanthus crassicaulis	Spindlestem	<1	<1	<1	<1	<1	<1	16.7
	Erigeron spp	Fleabane	<1	<1	<1	<1	<1	<1	25.0
	Eriogonum sp	Eriogonum sp	<1	<1	<1	<1	<1	<1	16.7
	Lilliaceae	Lily	<1	<1	<1	<1	<1	<1	16.7
	Penstemon sp	Penstemon	<1	<1	<1	<1	<1	<1	8.3
	Phlox hoodii	Hoods Phlox	0.3	0.7	0.2	0.0	2.0	0.7	50.0
	Phlox longifolia	Long leaved phlox	<1	<1	<1	<1	<1	<1	16.7
	Stanleya pinnata	Prince's plume	<1	<1	<1	<1	<1	<1	16.7
	Stephanomeria pauciflora	Wire Lettuce	<1	<1	<1	<1	<1	<1	8.3
	Unknown Composite		<1	<1	<1	<1	<1	<1	8.3
	Unknown Perennial Forb		0.1	0.3	0.1	0.0	1.0	0.2	16.7
		Sub-total	**0.6**	**0.9**	**0.3**	**0.0**	**2.0**	**1.6**	
Introduced Perennial Forbs									
	Carduus nutans	Musk thistle	<1	<1	<1	<1	<1	<1	8.3
	Malcolmia africana	African mustard	0.1	0.3	0.1	0.0	1.0	0.2	8.3
		Sub-total	**0.1**	**0.3**	**0.1**	**0.0**	**1.0**	**0.2**	

Table 1. Cont

	Scientific Name	Common Name	Avg	St Dev	St Error	Low	High	Rel Cover	Frequenc
Annual and biennial forbs									
	Atriplex spp	Saltbush	0.1	0.3	0.1	0.0	1.0	0.2	8.3
	Halogeton glomeratus	Halogeton	0.3	0.6	0.2	0.0	2.0	0.6	16.7
	Phacelia crenulata	Crenulate phacelia	<1	<1	<1	<1	<1	<1	8.3
	Sisymbrium altissimum	Tumbling Hedge Mustard	<1	<1	<1	<1	<1	<1	16.7
	Unknown chenopod	Chenopod	0.3	0.5	0.1	0.0	1.0	0.6	25.0
		Sub-total	**0.6**	**0.8**	**0.2**	**0.0**	**2.0**	**1.6**	
Sub-shrubs									
	Gutierrezia sarothrae	Broom Snakew eed	<1	<1	<1	<1	<1	<1	8.3
		Sub-total	<1	<1	<1	<1	<1	<1	
Shrubs									
	Artemisia nova	Black sagebrush	15.8	6.8	1.9	4.0	25.0	43.9	100.0
	Artemisia tridentata var wyomingensis	Wyoming big sagebrush	1.4	3.0	0.9	0.0	10.0	3.9	25.0
	Atriplex confertifolia	Shadscale	1.1	1.1	0.3	0.0	3.0	3.0	66.7
	Chrysothamnus nauseosus	Rubber Rabbitbrush	<1	<1	<1	<1	<1	<1	8.3
	Chrysothamnus viscidiflorus	Rabbitbrush	1.9	2.5	0.7	0.0	9.0	5.3	91.7
	Ephedra viridus	Green Mormon tea	0.7	1.4	0.4	0.0	5.0	1.9	58.3
	Grayia spinosa	Spiny hopsage	1.3	2.4	0.7	0.0	8.0	3.7	41.7
	Gutierrezia microcephala	Thread snakew eed	0.3	1.2	0.3	0.0	4.0	0.9	8.3
	Haplopappus nanus	Goldenw eed	0.7	2.3	0.7	0.0	8.0	1.9	8.3
	Tetradymia glabrata	Littleleaf horsebrush	2.1	4.2	1.2	0.0	13.0	5.8	25.0
	Tetradymia nuttallii	Nuttall's horsebrush	1.3	4.6	1.3	0.0	16.0	3.7	33.3
		Sub-total	**26.6**	**5.6**	**1.6**	**0.0**	**16.0**	**74.0**	
Cacti and succulents									
	Opuntia polyacantha	Plains Prickly Pear	<1	<1	<1	<1	<1	<1	25.0
		Sub-total	<1	<1	<1	<1	<1	<1	
Trees									
	Juniperus osteosperma	Utah juniper	0.3	0.9	0.3	0.0	4.0	0.7	16.7
	Pinus monophylla	Single leaf pinyon	0.1	0.3	0.1	0.0	1.0	0.2	25.0
		Sub-total	**0.3**	**0.9**	**0.3**	**0.0**	**4.0**	**0.9**	
Average # of second hits: 7									

Wyoming Big Sagebrush community: Wyoming big sagebrush covers about 31% of the total acreage of the mine sites. Wyoming big sagebrush generally dominates on the deeper soils on the sites as compared to black sagebrush. These soils are typically found on shallower slopes near and within valley bottoms. Total vegetation cover in this community type averaged 52.6 +/- 8.1%. Litter accounted for 15% of the total cover, while rock was 5.0%, gravel was 12.6%, and bare soil accounted for 23%. (See Table 2)

Wyoming big sagebrush was clearly the dominant shrub in the area and comprised 38.7% of the total vegetation cover. Hopsage was the next most prevalent shrub with 7.2% relative cover, and black sagebrush at 3.1% relative cover. Other important shrubs were viscid rabbitbrush (5.6% relative cover), and greasewood at 3.8% relative cover. Greasewood was sometimes a co-dominant or dominant within a few stands of Wyoming sagebrush (transects CM3 and CM4 at Cactus Mill), but was rarely present on other sites (See Figures 3 and 4).

Basin Big Sagebrush is also present in this and other communities along the edge of arroyos and occasionally on alluvial fans where deeper soils were found. It represents a minor component of the vegetation across the mine sites and is only co-dominant in very small narrow areas. Likewise, rubber rabbitbrush (*Chrysothamnus naseosus)* is found only in narrow bands along lower elevation arroyos particularly at Kiewit Leach, Kiewit Mine and Cactus Mill. These populations fall within Wyoming big sagebrush communities.

All grass species combined contributed 24.8% to the vegetation cover. Important cool season perennial grasses included Sandberg's bluegrass (8.6% relative cover), bottlebrush squirreltail (5.8% relative cover), bluebunch wheatgrass (*Elymus spicatus*) (3.5% relative cover, and Indian Ricegrass (3.4% relative cover). The invasive adventive annual- cheatgrass (*Bromus tectorum*) (4.7% relative cover) is a more common component here than in the other two main community types. It is widespread in the area and underscores the importance of careful and rapid re-vegetation of disturbed areas to prevent further spread. Other invasive adventive species of concern at the site include: African mustard (*Malcolmia africana*) musk thistle *(Carduus nutans)* and halogeton (*Halogeton glomeratus*).

All life classes of forbs (perennials, annuals, biennials) contributed only 0.5% of the total cover (or 0.9% relative cover). The following species of forbs are present in all three main community types at the mine sites: Beckwith's milkvetch (*Astragalus beckwithii*), Arabis (*Boechera) species*, *Castilleja* species, Spindlestem (*Caulanthus crassicaulis*), *Erigeron* species and carpet phlox (*Phlox hoodii*).
(See soil and vegetation maps in Appendix A)

Figure 4. View looking west- Kiewit Mine. Black sagebrush communities are in the foreground, Wyoming big sagebrush on the benches and arroyo bottoms below.

Figure 5. Wyoming big sagebrush community on valley bench.

Table 2. Wyoming big sagebrush community

Wyoming Sagebrush Gold Hill	n=12								
	Scientific Name	Common Name	Avg	St Dev	St Error	Low	High	Rel Cover	Frequer
Total Vegetation Cover			52.6	8.1	2.3	34.0	62.0		
Litter			15.2	5.2	1.5	5.0	24.0		
Rock			5.0	3.0	1.7	2.0	8.0		
Gravel			12.6	8.0	3.0	3.0	23.0		
Bare Soil			23.0	5.9	1.7	14.0	32.0		
Total Ground Cover			77.4	6.4	1.8	68.0	86.0		
Cool season perennial grasses									
	Elymus cinereus	Great Basin Wildrye	1.0	1.9	0.6	0.0	6.0	1.7	41.7
	Elymus elymoides	Bottlebrush Squirreltail	3.1	3.2	1.0	0.0	11.0	5.8	83.3
	Elymus spicatus	Bluebunch Wheatgrass	1.8	3.9	1.1	0.0	14.0	3.5	58.3
	Other cool season perennial grasses		0.2	0.6	0.2	0.0	2.0	0.3	8.3
	Poa fendleriana	Muttongrass	<1	<1	<1	<1	<1	<1	8.3
	Poa secunda	Sandberg Bluegrass	4.6	4.4	1.3	0.0	15.0	8.6	83.3
	Stipa comata	Needle-and-thread Grass	0.8	1.9	0.5	0.0	6.0	1.4	33.3
	Stipa hymenoides	Indian Ricegrass	1.8	2.1	0.6	0.0	7.0	3.4	83.3
		Sub-total	**13.2**	**11.4**	**3.3**	**0.0**	**17.0**	**24.8**	
Warm season perennial grasses									
	Hilaria jamesii	Galleta	0.9	2.6	0.7	0.0	9.0	1.6	25.0
		Sub-total	**0.9**	**2.6**	**0.7**	**0.0**	**9.0**	**1.6**	
Annual grasses									
	Bromus tectorum	Cheatgrass	2.5	3.0	0.9	0.0	8.0	4.7	83.3
		Sub-total	**2.5**	**3.0**	**0.9**	**0.0**	**8.0**	**4.7**	
Perennial forbs									
	Astragalus beckwithii	Beckwith's milkvetch	<1	<1	<1	<1	<1	<1	25.0
	Astragalus spp	Milkvetch	<1	<1	<1	<1	<1	<1	8.3
	Boechera sp	Rockcress	<1	<1	<1	<1	<1	<1	25.0
	Calochortus nuttallii	Mariposa Lily	<1	<1	<1	<1	<1	<1	8.3
	Castilleja sp	Paintbrush	<1	<1	<1	<1	<1	<1	8.3
	Caulanthus crassicaulis	Spindlestem	0.1	0.3	0.1	0.0	1.0	0.2	16.7
	Cryptantha flavoculata	Cat's eye	0.1	0.3	0.1	0.0	1.0	0.2	8.3
	Cryptantha spp	Cat's Eye	0.0	0.2	0.0	0.0	1.0	0.2	12.0
	Delphinium sp	Larkspur	<1	<1	<1	<1	<1	<1	8.3
	Erigeron spp	Fleabane	<1	<1	<1	<1	<1	<1	8.3
	Liliaceae	Lily	<1	<1	<1	<1	<1	<1	8.3
	Penstemon sp	Penstemon	<1	<1	<1	<1	<1	<1	8.3
	Phlox hoodii	Hoods Phlox	0.2	0.4	0.1	0.0	1.0	0.3	41.7
	Unknown Perennial Forb		0.1	0.3	0.1	0.0	1.0	0.2	8.3
		Sub-total	**0.5**	**0.7**	**0.2**	**0.0**	**1.0**	**0.9**	

Table 2 (cont)

	Scientific Name	Common Name	Avg	St Dev	St Error	Low	High	Rel Cover	Frequen
Annual and biennial forbs									
	Halogeton glomeratus	Halogeton	1.4	3.4	0.7	0.0	10.0	2.6	25.0
	Phacelia crenulata	Crenulate phacelia	0.1	0.3	0.1	0.0	1.0	0.2	8.3
	Sisymbrium altissimum	Tumbling Hedge Mustard	<1	<1	<1	<1	<1	<1	16.7
		Sub-total	**1.5**	**3.6**	**1.0**	**0.0**	**10.0**	**2.8**	
Sub-shrubs									
	Bassia americana	Gray Molly	<1	<1	<1	<1	<1	<1	18.2
	Gutierrezia sarothrae	Broom Snakeweed	<1	<1	<1	<1	<1	<1	9.1
		Sub-total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	
Shrubs									
	Artemisia nova	Black sagebrush	1.7	3.4	0.9	0.0	10.0	3.1	33.3
	Artemisia tridentata tridentata	Basin big sagebrush	1.2	4.0	1.2	0.0	14.0	2.4	16.7
	Artemisia tridentata var wyomingensis	Wyoming big sagebrush	20.6	11.2	3.2	0.0	40.0	38.7	91.7
	Atriplex confertifolia	Shadscale	0.3	0.6	0.2	0.0	2.0	0.5	33.3
	Chrysothamnus nauseosus	Rubber Rabbitbrush	<1	<1	<1	<1	<1	<1	8.3
	Chrysothamnus viscidiflorus	Rabbitbrush	3.0	3.2	0.9	0.0	8.0	5.6	91.7
	Ephedra viridus	Green Mormon tea	1.1	1.3	0.4	0.0	4.0	2.0	66.7
	Grayia spinosa	Spiny hopsage	3.8	4.1	1.2	0.0	13.0	7.2	66.7
	Sarcobatus vermiculatus	Black Greasewood	2.0	4.8	1.4	0.0	15.0	3.8	25.0
	Symphorocarpos longiflorus	Snowberry	<1	<1	<1	<1	<1	<1	8.3
	Tetradymia glabrata	Littleleaf horsebrush	<1	<1	<1	<1	<1	<1	16.7
	Tetradymia nuttallii	Nuttall's horsebrush	<1	<1	<1	<1	<1	<1	16.7
		Sub-total	**33.7**	**10.6**	**3.0**	**0.0**	**45.0**	**63.3**	
Cacti and succulents									
	Opuntia polyacantha	Plains Prickly Pear	0.3	0.5	0.1	0.0	1.0	0.5	33.3
		Sub-total	**0.3**	**0.5**	**0.1**	**0.0**	**1.0**	**0.5**	
Trees									
	Juniperus osteosperma	Utah juniper	0.3	1.2	0.3	0.0	4.0	0.6	16.7
	Pinus monophylla	Single leaf pinyon	0.5	1.0	0.3	0.0	3.0	0.8	50.0
		Sub-total	**0.8**	**2.1**	**0.6**	**0.0**	**4.0**	**1.4**	
Average # of second hits: 16									

Pinyon/Juniper Community: Singleleaf pinyon together with Utah juniper covers 21.2% of the total acreage of the mine sites. Total average vegetation cover in this community type is 42.9 +/-7.6%% with litter at an average of 14.7%, rock at 11.0%, gravel at 9.7% and bare soil at 26.0%. (See Table 3)
Although pinyon/juniper communities are found on every soil type and exposure across the study area, juniper is more drought and cold tolerant than pinyon, thus they tend to dominate sites at the lower and upper elevation ranges (See Figure 5). Pinyon typically dominates the mid-range elevations where both species occur. Generally the understory of pinyon/juniper communities is composed of species found in adjacent communities.

All grass species combined contributed 5.7% to the total vegetation cover (13.3% relative cover). The most common cool season perennial grass is Sandberg's bluegrass with an average total cover of 3.9% (9.1% relative cover), followed by Indian ricegrass (0.6% total cover) and bluebunch wheatgrass (0.5% total cover). All life classes of forbs (perennials, annuals, biennials) contributed only 1.1% of the total cover. Common forbs found in this community include carpet phlox (*Phlox hoodii*) and Beckwith's milkvetch (*Astragalus beckwithii*).

Average total shrub cover is 9.0%, which translates to 20.9% relative cover. Within the shrub layer black sagebrush accounts for 5.5%, Wyoming big sagebrush is 0.9% and viscid rabbitbrush is 0.8% (total cover). Other shrubs of note but minor cover include cliffrose (*Purshia Mexicana var. stansburyana*), green ephedra (*Ephedra viridis)*, Basin big sagebrush, and hopsage.
(See soil and vegetation maps in Appendix A)

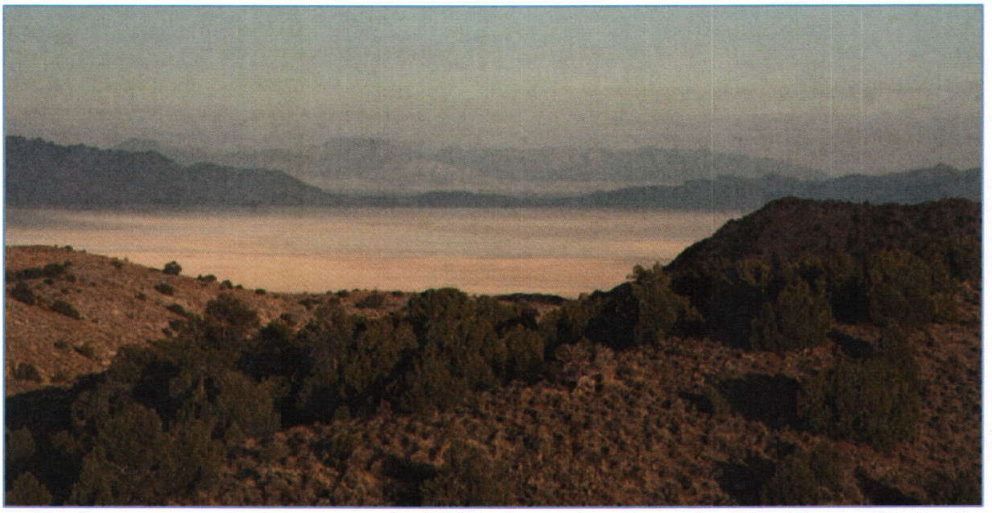


Figure 6.Pinyon/juniper community interspersed with black sagebrush overlooking Bonneville basin.

Table 3. Pinyon/juniper community

	Pinyon / juniper Gold Hill n=10								
	Scientific Name	Common Name	Avg	St Dev	St Error	Low	High	Rel cover	Frequenc
Total Vegetation Cover			42.9	7.6	2.4	30.0	56.0		
Litter			14.7	4.4	1.3	10.0	22.0		
Rock			11.0	7.4	2.8	1.0	21.0		
Gravel			9.7	6.2	2.1	3.0	20.0		
Bare Soil			26.0	7.9	2.5	17.0	37.0		
Total Ground Cover			74.0	7.9	2.5	63.0	83.0		
Cool season perennial grasses									
	Elymus cinereus	Great Basin Wildrye	0.0	0.0	0.0	0.0	0.0	0.0	10.0
	Elymus elymoides	Bottlebrush Squirreltail	0.3	0.7	0.2	0.0	2.0	0.5	70.0
	Elymus spicatus	Bluebunch Wheatgrass	0.5	1.0	0.3	0.0	3.0	1.2	30.0
	Poa fendleriana	Muttongrass	<1	<1	<1	<1	<1	<1	10.0
	Poa sandbergii	Sandberg Bluegrass	3.9	2.4	0.8	1.0	9.0	9.1	100.0
	Stipa comata	Needle-and-thread Grass	0.4	1.3	0.4	0.0	4.0	0.9	40.0
	Stipa hymenoides	Indian Ricegrass	0.6	1.0	0.3	0.0	3.0	1.4	70.0
		Sub-total	**5.7**	**3.7**	**1.2**	**1.0**	**13.0**	**13.3**	
Annual grasses									
	Bromus tectorum	Cheatgrass	0.6	0.7	0.2	0.0	2.0	1.4	100.0
		Sub-total	**0.6**	**0.7**	**0.2**	**0.0**	**2.0**	**1.4**	
Perennial forbs									
	Antennaria microphylla	Littleleaf Pussytoes	<1	<1	<1	<1	<1	<1	10.0
	Astragalus beckwihii	Beckwith's milkvetch	0.2	0.6	0.2	0.0	2.0	0.5	20.0
	Astragalus lentiginosus var araneosu	Cobweb milkvetch	<1	<1	<1	<1	<1	<1	10.0
	Astragalus spp	Milkvetch	0.1	0.3	0.1	0.0	1.0	0.2	20.0
	Astragalus utahensis	Utah lady finger	<1	<1	<1	<1	<1	<1	10.0
	Boechera sp	Rockcress	0.1	0.3	0.1	0.0	1.0	0.2	30.0
	Castilleja sp	Paintbrush	0.1	0.3	0.1	0.0	1.0	0.2	10.0
	Caulanthus crassicaulis	Spindlestem	<1	<1	<1	<1	<1	<1	20.0
	Cryptantha flavoculata	Cat's eye	<1	<1	<1	<1	<1	<1	10.0
	Cryptantha spp	Cat's Eye	<1	<1	<1	<1	<1	<1	20.0
	Erigeron spp	Fleabane	<1	<1	<1	<1	<1	<1	10.0
	Eriogonum sp	Eriogonum sp	<1	<1	<1	<1	<1	<1	20.0
	Lilliaceae	Lily	<1	<1	<1	<1	<1	<1	10.0
	Phlox hoodii	Hoods Phlox	0.6	1.3	0.4	0.0	4.0	1.4	70.0
	Stanleya pinnata	Prince's plume	0.0	0.0	0.0	0.0	0.0	0.0	10.0
		Sub-total	**1.1**	**1.5**	**0.5**	**0.0**	**4.0**	**2.6**	

Table 3 (cont)

	Scientific Name	Common Name	Avg	St Dev	St Error	Low	High	Rel cover	Frequenc
Annual and biennial forbs									
	Brassica nigra	Black mustard	<1	<1	<1	<1	<1	<1	10.0
	Machaeranthera canescens	Silvery Aster	<1	<1	<1	<1	<1	<1	10.0
	Stellaria sp	Chickweed	<1	<1	<1	<1	<1	<1	30.0
		Sub-total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	
Sub-shrubs									
	Gutierrezia sarothrae	Broom Snakeweed	<1	<1	<1	<1	<1	<1	10.0
	Krascheninnikovia lanata	Winterfat	<1	<1	<1	<1	<1	<1	10.0
	Leptodactylon pungens	Prickly gilia	0.1	0.3	0.1	0.0	1.0	0.2	10.0
		Sub-total	**0.1**	**0.3**	**0.1**	**0.0**	**1.0**	**0.2**	
Shrubs									
	Artemisia nova	Black sagebrush	5.5	4.1	1.3	0.0	11.0	12.8	90.0
	Artemisia tridentata	Big Sagebrush	0.6	1.9	0.6	0.0	6.0	1.4	10.0
	Artemisia tridentata var wyomingensis	Wyoming big sagebrush	0.9	1.9	0.6	0.0	5.0	2.1	30.0
	Atriplex confertifolia	Shadscale	<1	<1	<1	<1	<1	<1	20.0
	Chrysothamnus viscidiflorus	Rabbitbrush	0.8	1.3	0.4	0.0	4.0	1.8	50.0
	Ephedra viridus	Green Mormon tea	0.4	1.0	0.3	0.0	3.0	0.9	60.0
	Grayia spinosa	Spiny hopsage	0.2	0.6	0.2	0.0	2.0	0.5	20.0
	Purshia mexicana	Cliffrose	0.5	1.6	0.5	0.0	5.0	1.2	10.0
	Symphorocarpos longiflorus	Snowberry	0.1	0.3	0.1	0.0	1.0	0.2	10.0
	Tetradymia nuttallii	Nuttall's horsebrush	0.0	0.0	0.0	0.0	0.0	0.0	10.0
		Sub-total	**9.0**	**3.9**	**1.3**	**0.0**	**14.0**	**20.9**	
Trees									
	Juniperus osteosperma	Utah juniper	14.0	6.1	1.9	5.0	25.0	32.6	100.0
	Pinus monophylla	Single leaf pinyon	12.4	5.7	1.8	0.0	19.0	28.9	100.0
		Sub-total	**29.0**	**11.6**	**3.7**	**0.0**	**29.0**	**61.5**	
Average # of second hits: 9									

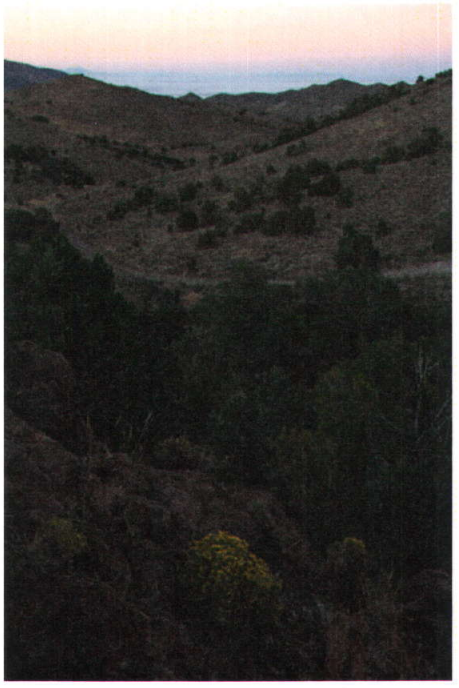


Figure 7. Photo of pinyon juniper community interspersed with sagebrush communities

SOILS

The following soil types are found within the parcels. All soil descriptions were derived from USDA- Soil Survey of Tooele Area, Utah (NRCS Soil Survey issued 2000).

Soil type 4- Amtoft-Rock outcrop complex, 30 to 70 percent slopes.
This soil is typically composed of 65% Amtoft very cobbly loam, 15% rock outcrop and 20% other soils, and is found on mountainsides and hillsides. The Amtoft soil is shallow and somewhat excessively drained and formed in residuum and colluvium derived dominantly from limestone. Rock outcrops consist of exposures of nearly barren limestone, mainly on escarpments and ridges. Small inclusions of other soils include the shallow Lodar and Lundy soils on upper slopes under Utah Juniper and singleleaf pinyon, shallow Checkett soils under black sagebrush, Hiko Peak and Spager soils on high fan remnants and deep Cliffdown soils on low fan remnants under Wyoming big sagebrush. This soil type occurs on 6 of the 11 parcels including Rustler, Lucy Pit, Frankie Pit, Kiewit Leach, Kiewit Mine, and Cactus Mill (See soil and vegetation maps in Appendix A)

Soil type 11- Checkett-Rock outcrop complex, 10 to 40 percent slopes.
This soil is composed of about 75% Checkett very cobbly loam, 10% Rock outcrop, and 15% other soils and is found on mountainsides and hillsides. The Checkett soils are shallow and well drained, and formed from residuum and colluvium derived mainly from igneous and metamorphic rocks.
Rock outcrops occur on escarpments and ridges. Small inclusions of Hiko Peak soils occur on fan remnants and in drainage ways and shallow Reywat soils occur on north facing mountainsides and areas with slopes greater than 40%. Present vegetation in most areas is black sagebrush, cheatgrass, Sandberg's bluegrass and Indian ricegrass.

This soil type occurs on 2 of 11 parcels including Kiewit Mine and Cactus Mill (See soil and vegetation maps in Appendix A)

Soil type 21- Hiko Peak gravelly loam, 2 to 15 percent slopes.
Hiko Peak soil is a very deep and well drained- formed in alluvium derived from mixed rock sources and is found on fan remnants Included in about 10% of this mapping unit are small areas of loamy Medburn soils on the shallower sloping lower fan remnants, the sandy Berent soils of stabilized sand dunes under juniper, and Sprager soils in positions similar to those of the Hiko Peak soil. Present vegetation in most areas of Hiko Peak soil is pinyon/ juniper communities, Wyoming sagebrush communities with rubber and viscid rabbitbrush along arroyos. Greasewood occurs where this unit enters the Cactus Mill site at the north east corner.
This soil type occurs on 2 of 11 parcels including Cactus Mill and under the majority of the area on Kiewit Leach (See soil and vegetation maps in Appendix A)

Soil type 48- Reywat-Broad-Rock outcrop association, 30 to 60 percent slopes.
The unit is about 45% Reywat very cobbly loam mainly on droughty south aspects or on short or medium length convex slopes of hills and mountainsides. Reywat is a shallow and well drained soil formed in residuum and colluvium derived dominantly from quartzite and igneous rocks. About 30% of the unit is the Broad soil- a moderately deep and well drained cobbly loam formed in residuum and colluviums from quartzite and sandstone. Broad soil is found mainly on moister north aspects. Rock outcrops compose about 10% of the unit and are barren bedrock on escarpments and ridges. Rock outcrops and other soils comprise a total of 25% of the unit and include small areas of deep Abela soils that are found in drainage ways. Shallow Lodar soils are found in landscape positions similar to the Reywat and shallow Lundy soils in positions similar to the Broad soils.
This soil unit supports pinyon/juniper, black sagebrush and Wyoming sagebrush communities and occurs on 8 of 11 of the parcels including Frankie Pit, Lucy Pit, North Area, Kiewit Leach and Yellow Hammer.
(See soil and vegetation maps in Appendix A).

Conclusion

Overall, 310.6 acres were examined for this study. The community type acreages and percentage of the total area were: Basin Big Sagebrush 2.7 acres (<1%), black sagebrush 126.7 acres (41%), singleleaf pinyon/ Utah Juniper 65.8 acres (21.2%), Wyoming big sagebrush 96.6 acres (31.1%), rubber rabbitbrush 4.2 acres (1.3%), and disturbed areas comprised 13.9 acres (4.3%).

Plant community types were correlated with landscape position and soil type and depths. Soils supporting black sagebrush are typically shallow and xeric. Pinyon/juniper communities are found on every major soil unit and exposure across the study area, however juniper was over twice as prevalent as pinyon. Diversity and percent cover for grasses and forbs are relatively low for all communities, perhaps due to a combination of numerous record dry years and grazing pressure in some areas.

To reach an acceptable vegetation cover in each of these vegetation types for future bond release, the lands must exhibit 70% of the baseline vegetation cover. Thus, the following vegetation cover targets for each community type are:
Black sagebrush: 25% +/- 8% total vegetation cover
Wyoming sagebrush: 36% +/- 8% total vegetation cover

Pinyon/juniper: 30% +/- 7% vegetation cover

Although the vegetation communities are distinct in this area, most share common species that are readily available for reclamation. At the time of reclamation, it is suggested to add a forb to the mix. Availability of forb seeds varies greatly and it would likely be best to seek an appropriate forb for this mix at the time of reclamation. The following seed mix is suggested for reclamation in these areas:

Black sagebrush

Common name	Scientific name	Variety	PLS lbs	# seeds/ lb	% of mix
Sandberg's bluegrass	*Poa secunda*		0.75	925000	24
Indian ricegrass	*Oryzopsis hymenoides*	Rimrock	3	183000	19
Bluebunch wheatgrass	*Pseudoroegneria spicata*	P-7	5	125680	22
Bottlebrush squirreltail	*Elymus elymoides*		3	191555	20
Shrubs					
Black sagebrush	*Artemisia nova*		0.5	907200	15
		Total PLS lbs	12.3		
		Seeds/sq ft.	67		

APPENDIX A - Vegetation and Soil Types

Figure 1. Cactus Mill vegetation types, soil types and transect locations (UTM NAD 83 CONUS)

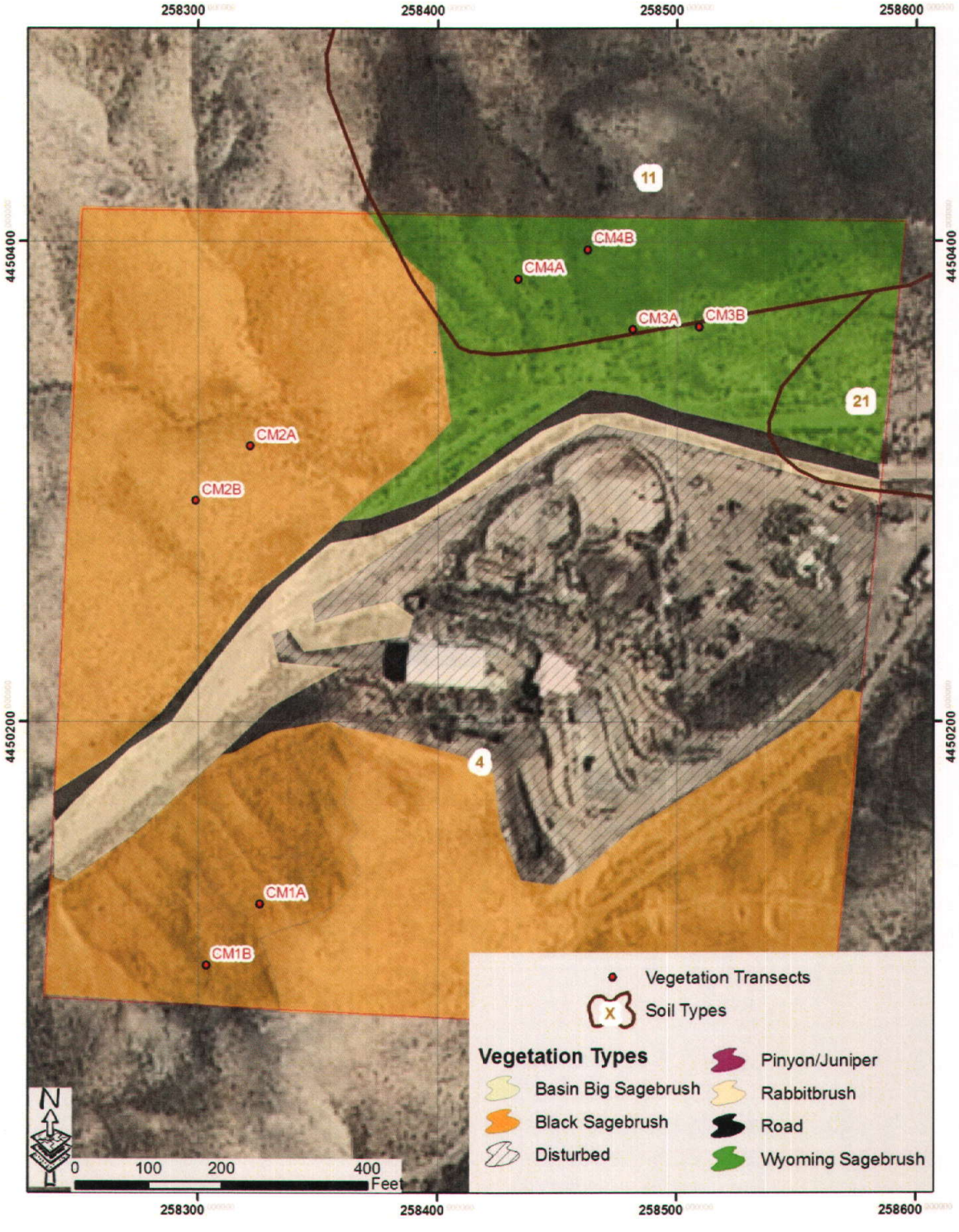


Figure 2. Frankie Pit soil types, vegetation types and transect locations (UTM NAD 83 CONUS).

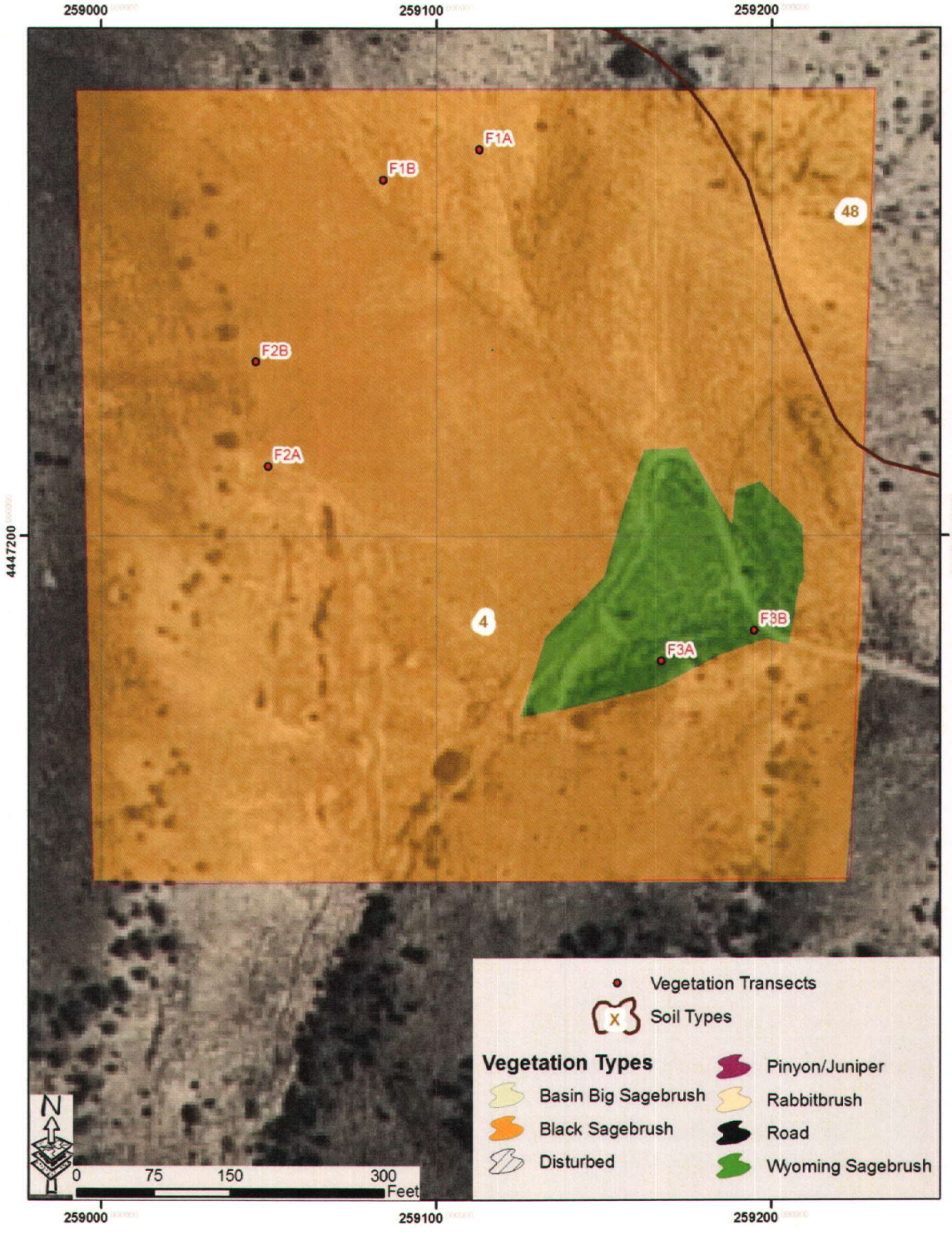


Figure 3. Lucy Pit soil types, vegetation types and transect locations (UTM NAD 83 CONUS)

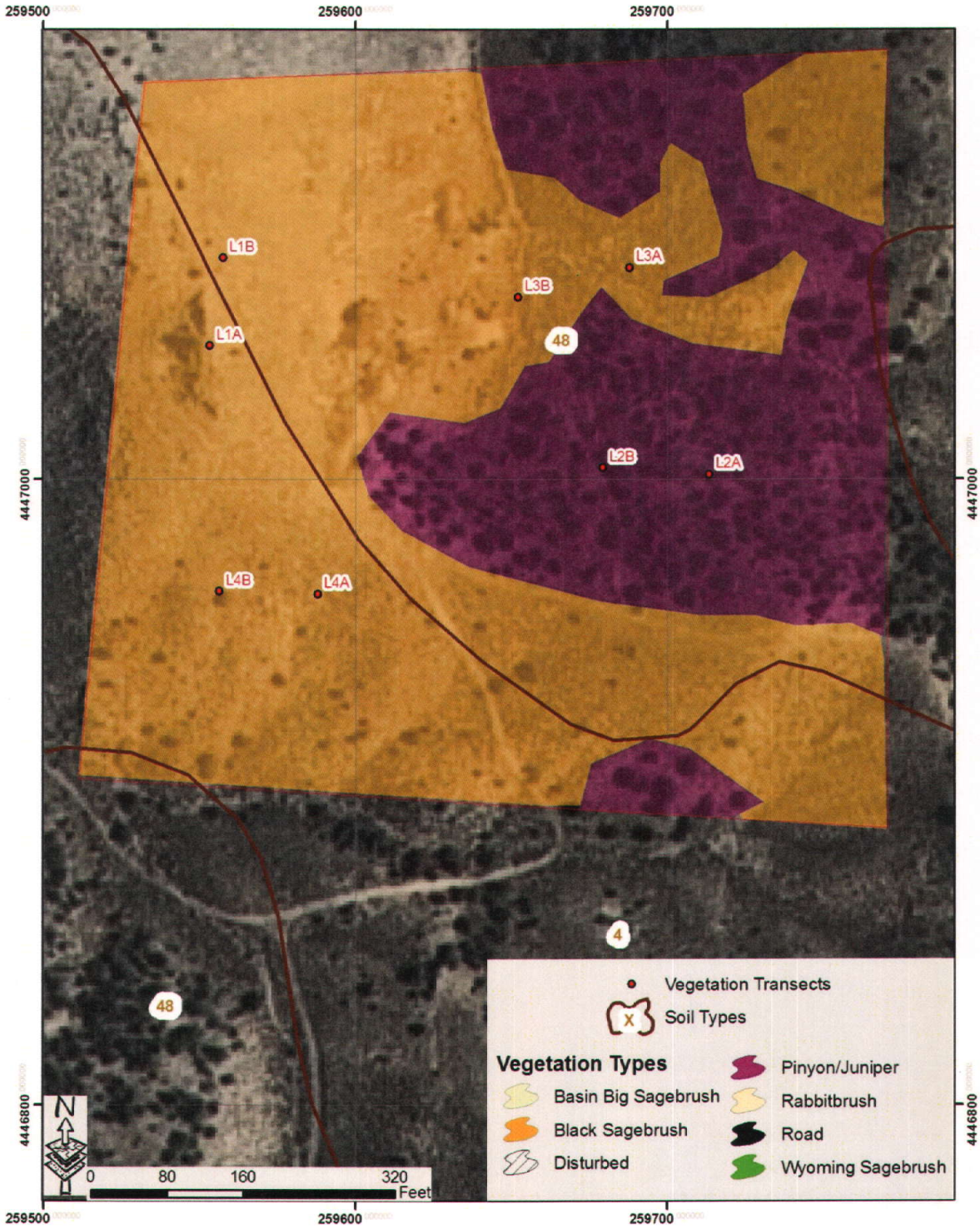


Figure 4. North Area soil types, vegetation types and transect locations (UTM NAD 83 CONUS)

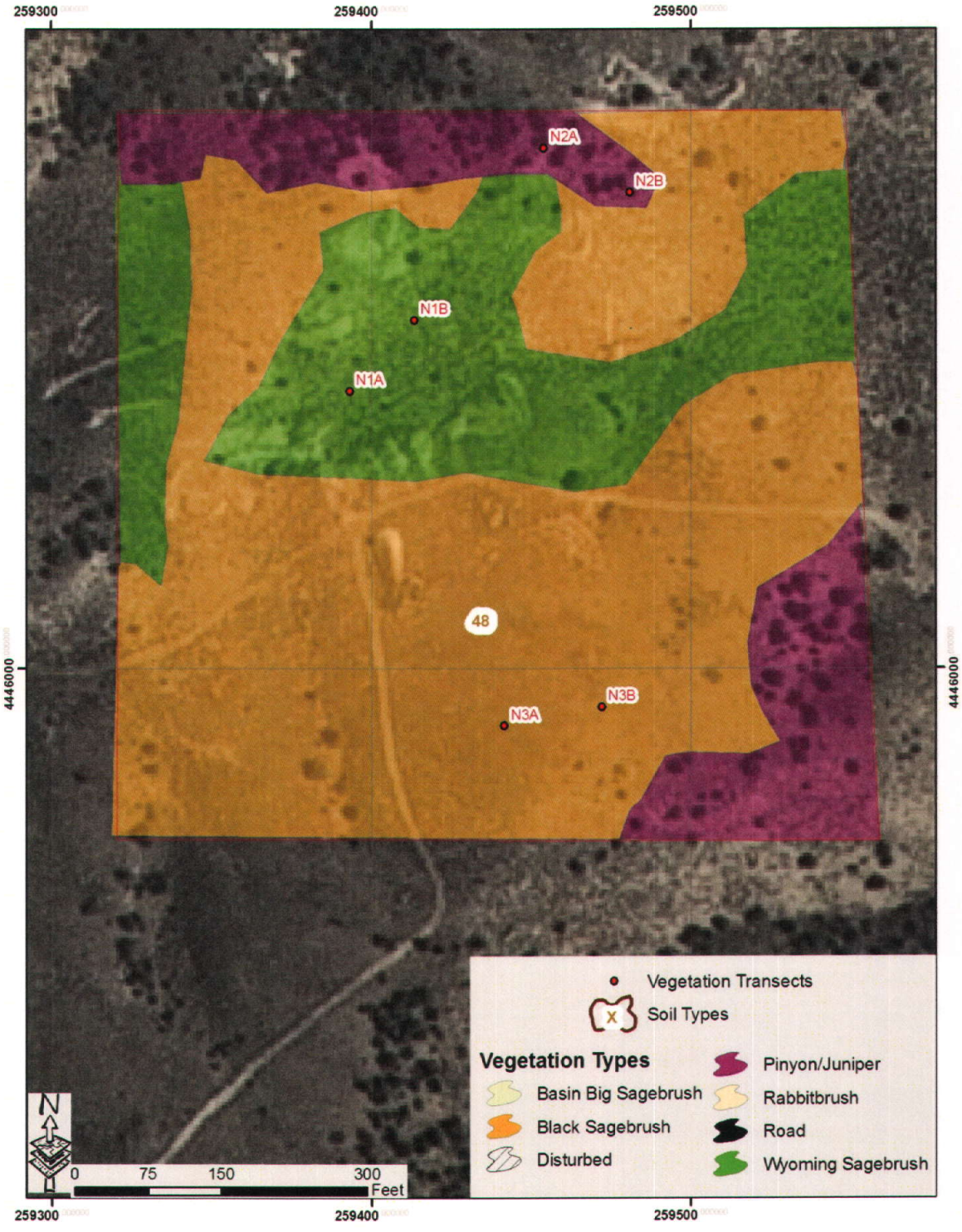


Figure 5. Yellow Hammer complex soil types, vegetation types and transect locations (UTM NAD 83 CONUS)

Figure 6. Rustler soil types, vegetation types and transect locations (UTM NAD 83 CONUS)

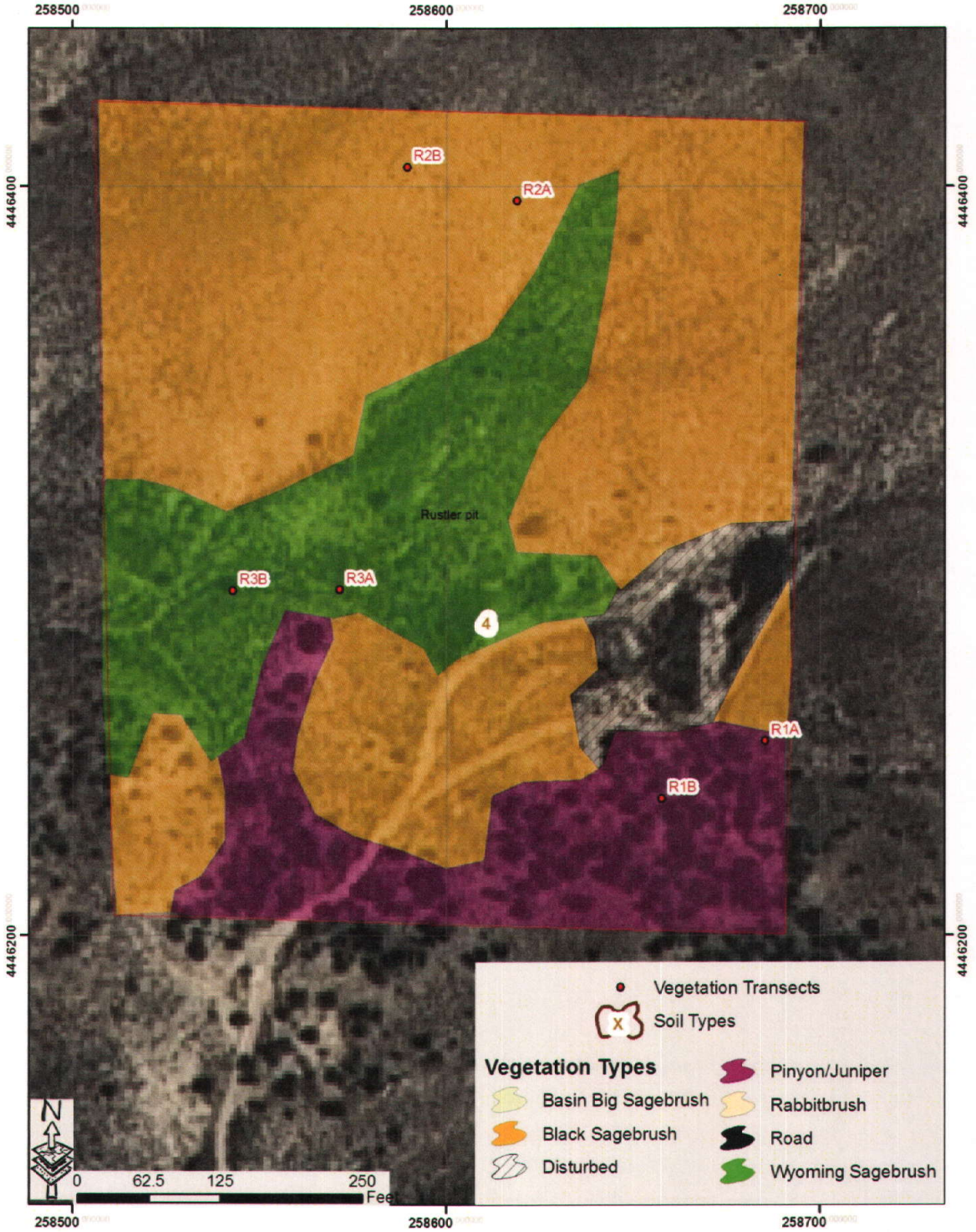


Figure 7. Kiewit Lech soil types, vegetation types and transect locations

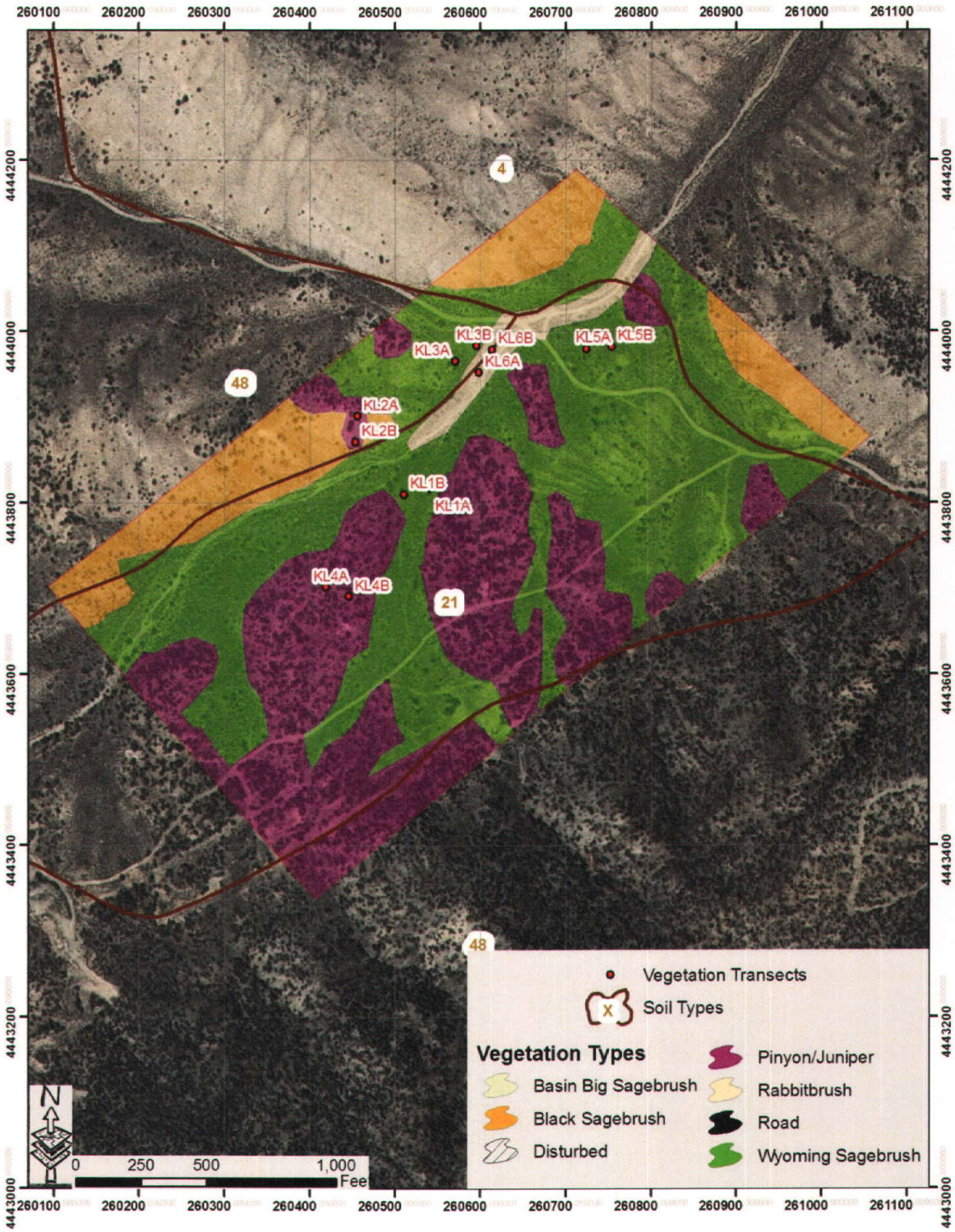


Figure 8. Kiewit Mine soil types, vegetation types and transect locations

APPENDIX B- TRANSECT PHOTOGRAPHS

Kiewit Leach- Transect KL1- Point A, Photo 5142
View looking west north west.

Wyoming Big Sage Community

Soil type 21- Hiko Peak gravelly loam, 2 to 15% slopes.

Principal vegetation components include Wyoming Big Sagebrush (*Artemisia tridentata var. wyomingensis*), Hopsage (*Grayia spinosa*), Viscid rabbitbrush (*Chrysothamnus viscidiflorus*), Cheatgrass (*Bromus tectorum*), Squirreltail (*Elymus elymoides*) and Sandberg's bluegrass (*Poa secunda*).

Minor vegetation components include Bluebunch wheatgrass (*Elymus spicatus*), Great Basin Wildrye (*Elymus cinereus),* Singleleaf Pinyon (*Pinus monophylla*), *Cryptantha* species, *Asteraceae* species, *Polemoniaceae* species, *Opuntia* species and Indian Ricegrass (*Stipa hymenoides*).

Kiewit Leach- Transect KL1- Point B, Photo 5145
View looking east south east.

Other species noted within 3' each side of the transect include *Astragalus* species, *Castilleja* species, Utah Juniper (*Juniperus osteosperma*) and Green Ephedra (*Ephedra viridis).*

Kiewit Leach- Transect KL2- Point A, Photo 5146
View looking south.

Kiewit Leach- Transect KL2- Point B, Photo 5147
View looking north.

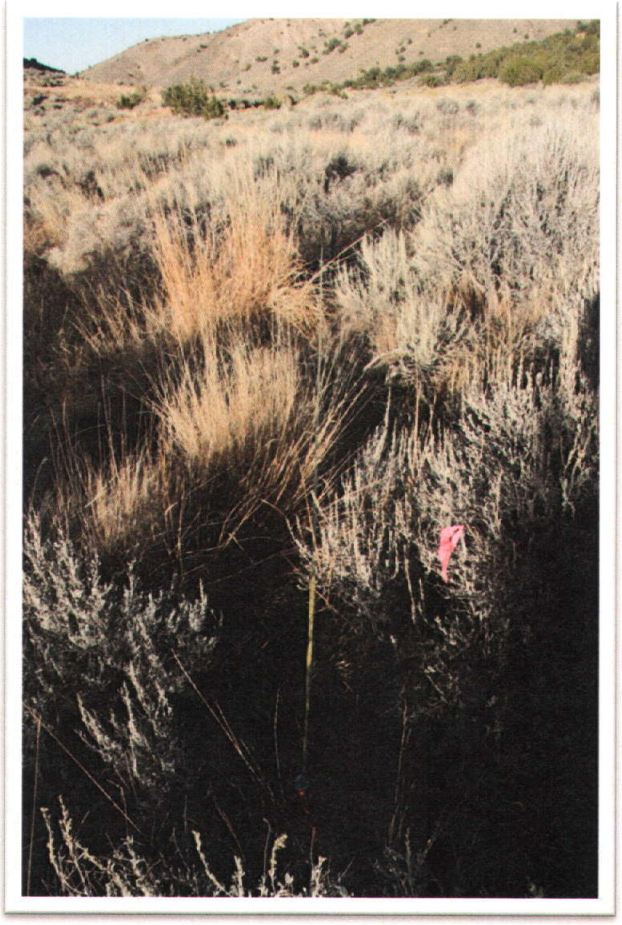
Pinyon/Juniper Community

Soil type 48- Reywat-Broad-Rock outcrop association, 30 to 60 percent slopes.

Principal vegetation components include Singleleaf Pinyon (*Pinus monophylla*) and Utah Juniper (*Juniperus osteosperma*) and Black sagebrush (*Artemisia nova*).

Minor vegetation components Sandberg's bluegrass (*Poa secunda*), Indian Ricegrass (*Stipa hymenoides*), Bluebunch wheatgrass (*Elymus spicatus*), Winterfat (Krascheninnikovia lanata) and Green Ephedra (*Ephedra viridis).*

Other species noted within 3' each side of the transect include *Eriogonum* species, Roughseed Cryptanth (*Cryptantha flovoculata),* Cheatgrass (*Bromus tectorum*), Muttongrass (*Poa fendleriana)* and Viscid rabbitbrush (*Chrysothamnus viscidiflorus*).



Kiewit Leach- Transect KL3- Point A, Photo 5149
View looking north east.

Kiewit Leach- Transect KL3- Point B, Photo 5150
View looking south west.

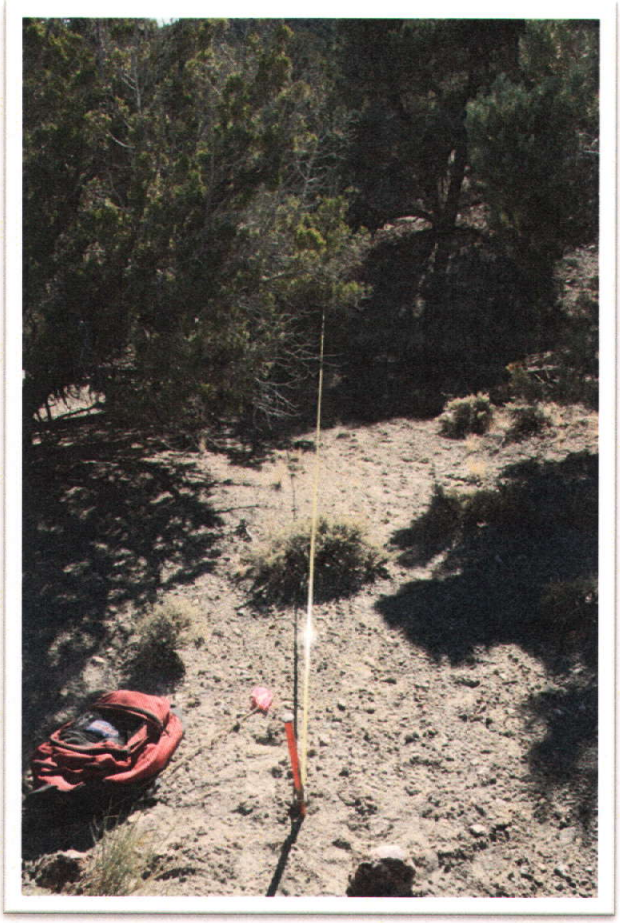
Wyoming Big Sagebrush community

Soil type 48- Reywat-Broad-Rock outcrop association, 30 to 60 percent slopes.

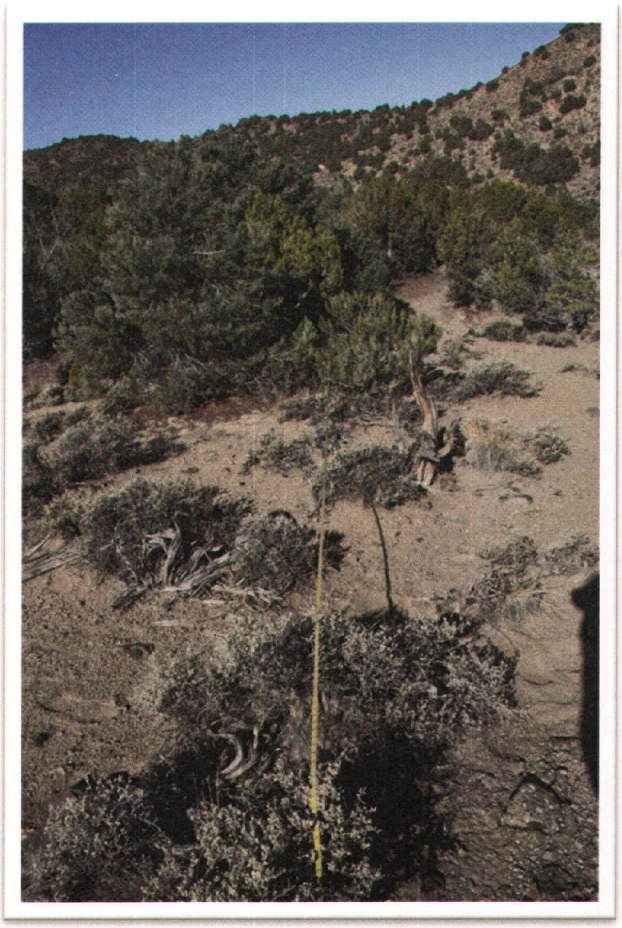
Principal vegetation components include Wyoming Big Sagebrush (*Artemisia tridentata var. wyomingensis*), Bluebunch wheatgrass (*Elymus spicatus*), Sandberg's bluegrass (*Poa secunda*), Squirreltail (*Elymus elymoides*) and Hopsage (*Grayia spinosa*).

Minor vegetation components include Green Ephedra (*Ephedra viridis),* Great Basin Wildrye (*Elymus cinereus),* Cheatgrass (*Bromus tectorum*), Roughseed Cryptanth (*Cryptantha flovoculata)* and Indian Ricegrass (*Stipa hymenoides*).

Other species noted within 3' each side of the transect include Viscid rabbitbrush (*Chrysothamnus viscidiflorus*), Carpet phlox (*Phlox hoodii*), *Opuntia* species, Muttongrass (*Poa fendleriana),* Sego Lily (*Calochortus nutallii)* and cryptobiotic crusts.



Kiewit Leach- Transect KL4- Point A, Photo 5151
View looking east south east.



Kiewit Leach- Transect KL4- Point B, Photo 5152
View looking west north west.

Pinyon/Juniper Community

Soil type 21- Hiko Peak gravelly loam, 2 to 15% slopes.

Principal vegetation components include Singleleaf Pinyon (*Pinus monophylla*), Utah Juniper (*Juniperus osteosperma*), Black sagebrush (*Artemisia nova*) and Sandberg's bluegrass (*Poa secunda*).

Other species noted within 3' each side of the transect include Squirreltail (*Elymus elymoides*), Cheatgrass (*Bromus tectorum*), Indian Ricegrass (*Stipa hymenoides*), *Astragalus* species, Carpet phlox (*Phlox hoodii*), *Phlox* species, *Cryptantha* species and *Boechera* species.

Kiewit Leach- Transect KL5- Point A, Photo 5153
View looking north west.

Kiewit Leach- Transect KL5- Point B, Photo 5154
View looking south east.

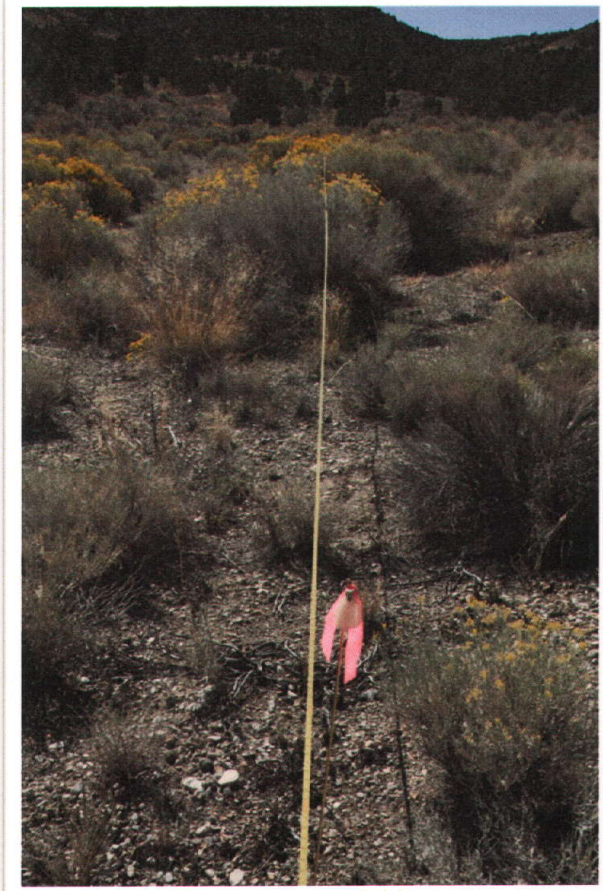
Wyoming Big Sagebrush Community

Soil type 21- Hiko Peak gravelly loam, 2 to 15% slopes.

Principal vegetation components include Wyoming Big Sagebrush (*Artemisia tridentata var. wyomingensis*), Viscid rabbitbrush (*Chrysothamnus viscidiflorus*), Hopsage (*Grayia spinosa*), Sandberg's bluegrass (*Poa secunda*), Needle-and-thread grass (*Stipa comata*), Great Basin Wildrye (*Elymus cinereus),* and Cheatgrass (*Bromus tectorum*).
Minor vegetation components include Singleleaf Pinyon (*Pinus monophylla*), Utah Juniper (*Juniperus osteosperma*), Green Ephedra (*Ephedra viridis),* Carpet phlox (*Phlox hoodii*) , Bluebunch wheatgrass (*Elymus spicatus*), Galleta (*Hilaria jamesii*), Indian Ricegrass (*Stipa hymenoides*)and Squirreltail (*Elymus elymoides*).

Other species noted within 3' each side of the transect include *Cryptantha* species, *Penstemon* species and Spindlestem (*Caulanthus crassicaulis*). Cryptobiotic soils present.

Kiewit Leach- Transect KL6- Point A, Photo 5155
View looking north east.



Kiewit Leach- Transect KL6- Point B, Photo 5156
View looking south west.

Rubber Rabbitbrush Community

Soil type 21- Hiko Peak gravelly loam, 2 to 15% slopes.

Principal vegetation components include Rubber Rabbitbrush (*Chrysothamnus naseosus),* Squirreltail (*Elymus elymoides*), Crested Wheat (*Agropyron cristatum*) and Viscid rabbitbrush (*Chrysothamnus viscidiflorus*).
Minor vegetation components include Indian Ricegrass (*Stipa hymenoides*), Needle-and-thread grass (*Stipa comata*), Bluebunch wheatgrass (*Elymus spicatus*), Great Basin Wildrye (*Elymus cinereus),* Sandberg's bluegrass (*Poa secunda*), Cheatgrass (*Bromus tectorum*) and Palmer's Penstemon (*Penstemon palmeri)* and *Astragalus* species.

Other species noted within 3' each side of the transect include *Linum* species and Wyoming Big Sagebrush (*Artemisia tridentata var. wyomingensis*).

Kiewit Mine- Transect KM1- Point A, Photo 5116
View looking north.

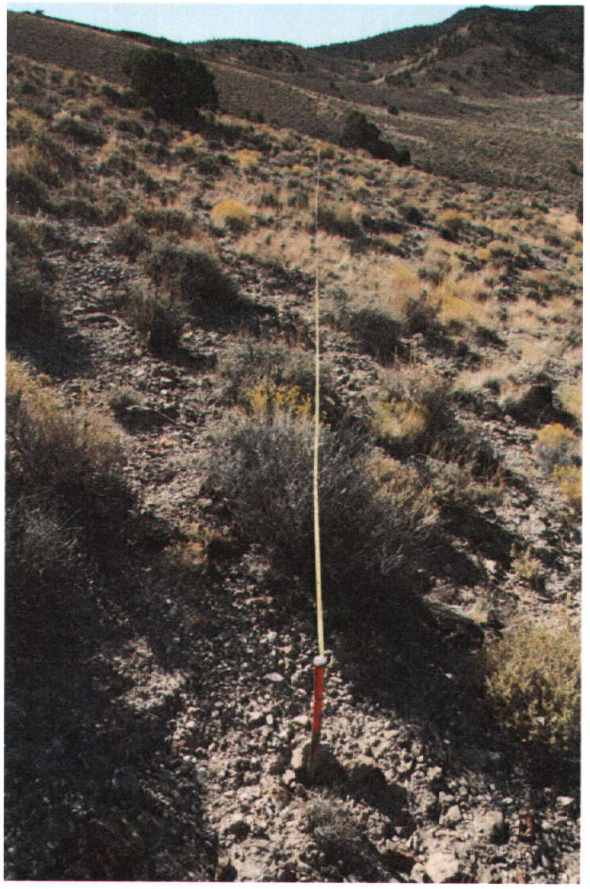
Kiewit Mine- Transect KM1- Point B, Photo 5117
View looking south.

Wyoming Big Sagebrush Community

Soil type 4- Amtoft-Rock outcrop complex, 30% to 70% slopes.

Common vegetation components include Wyoming Big Sagebrush (*Artemisia tridentata var. wyomingensis*), Hopsage (*Grayia spinosa*) and Cheatgrass (*Bromus tectorum*).

Minor vegetation components include Sandberg's bluegrass (*Poa secunda*), Indian Ricegrass (*Stipa hymenoides*) and Squirreltail (*Elymus elymoides*).



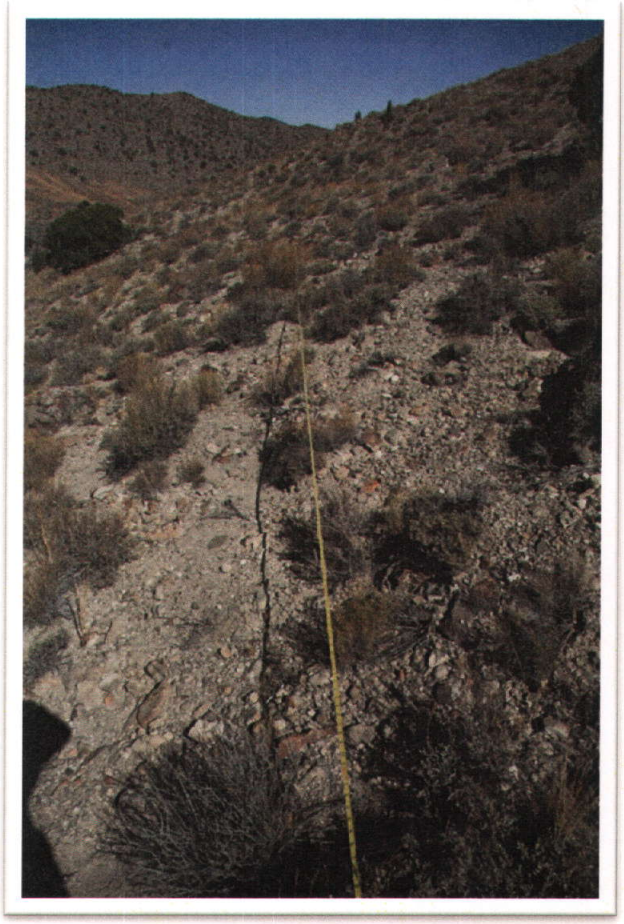
Kiewit Mine- Transect KM2- Point A, Photo 5118
View looking south south east.

Black Sagebrush Community

Soil type 4- Amtoft-Rock outcrop complex, 30% to 70% slopes.

Common vegetation components include Black sagebrush (*Artemisia nova*), Littleleaf horsebrush (*Tetradymia glabrata*), Bluebunch wheatgrass (*Elymus spicatus*) and Sandberg's bluegrass (*Poa secunda*).

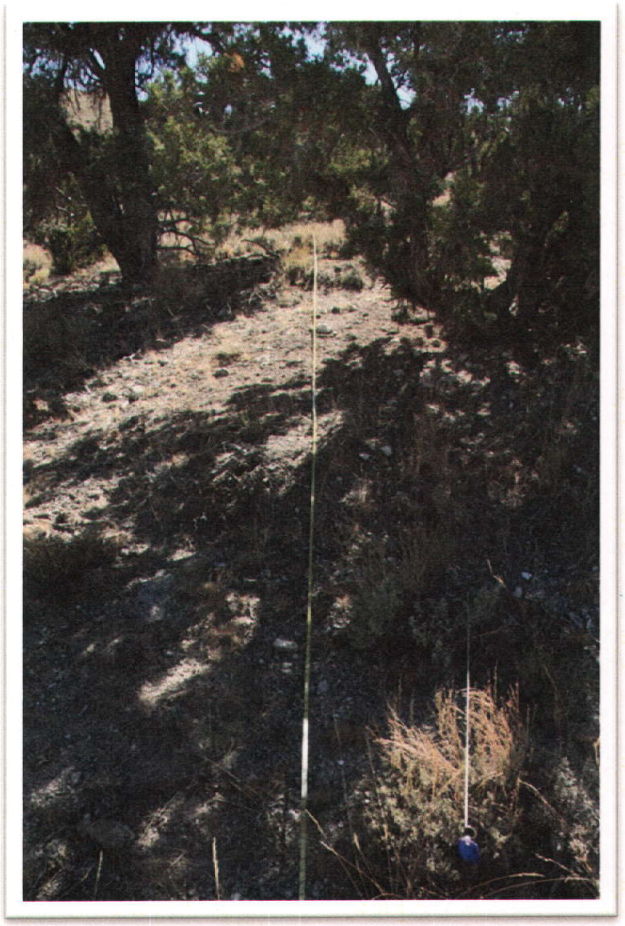
Minor vegetation components include Shadscale (*Atriplex confertifolia),* Thread snakeweed (*Gutierrezia microcephala*), Cheatgrass (*Bromus tectorum*), Indian Ricegrass (*Stipa hymenoides*) and Galleta (*Hilaria jamesii*).



Kiewit Mine- Transect KM2- Point B, Photo 5120
View looking north north west.

Other species within 3' each side of the transect include Spindlestem (*Caulanthus crassicaulis*), *Erigeron* species, *Penstemon* species, and *Chenopodiaceae* species.

Kiewit Mine- Transect KM3- Point A, Photo 5121
View looking north west.



Kiewit Mine- Transect KM3- Point B, Photo 5122
View looking south east.

Pinyon/Juniper Community

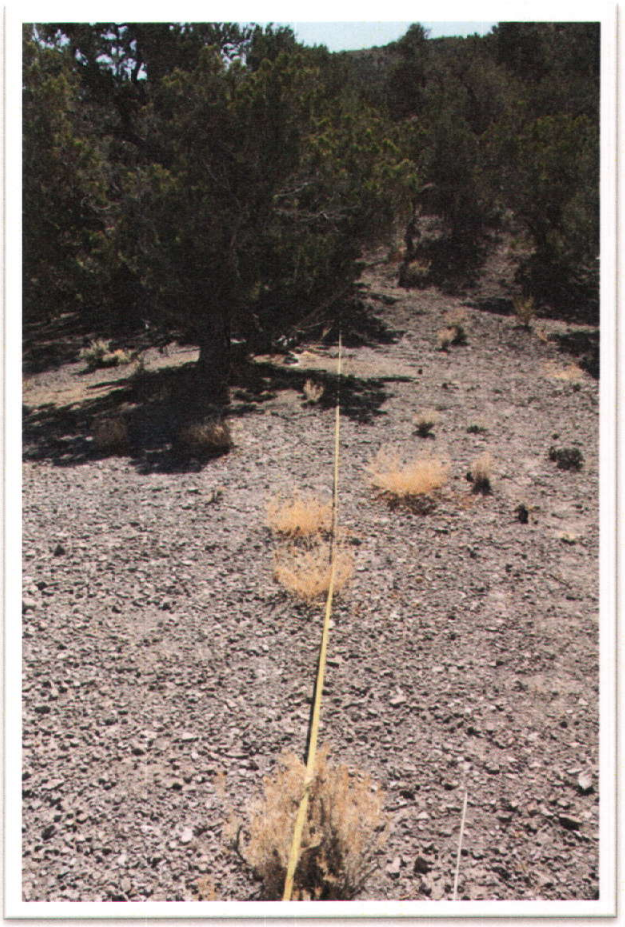
Soil type 4- Amtoft-Rock outcrop complex, 30% to 70% slopes.

Principal vegetation components include Singleleaf Pinyon (*Pinus monophylla*), Utah Juniper (*Juniperus osteosperma*), Black sagebrush (*Artemisia nova*) and Sandberg's bluegrass (*Poa secunda*).

Minor vegetation components include Carpet phlox (*Phlox hoodii*) and Bluebunch wheatgrass (*Elymus spicatus*).

Other species noted within 3' each side of the transect include Broom snakeweed (Gutierrezia sarothrae), Prince's plume (*Stanleya pinnata*), Squirreltail (*Elymus elymoides*), Cheatgrass (*Bromus tectorum*), Shadscale (*Atriplex confertifolia), Erigeron* and *Stellaria species.*

Kiewit Mine- Transect KM4- Point A, Photo 5124
View looking north north east.



Kiewit Mine- Transect KM4- Point B, Photo 5126
View looking south south west.

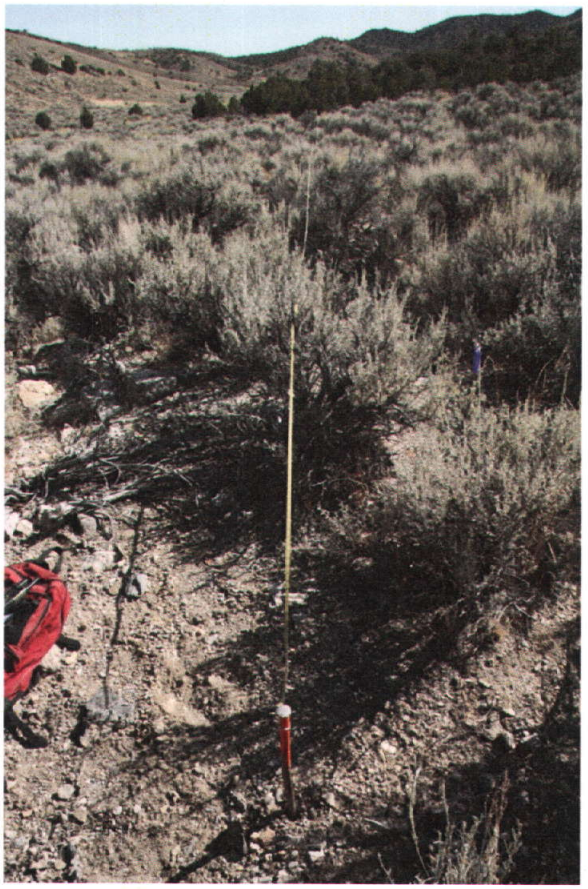
Pinyon/Juniper Community

Soil type 4- Amtoft-Rock outcrop complex, 30% to 70% slopes.

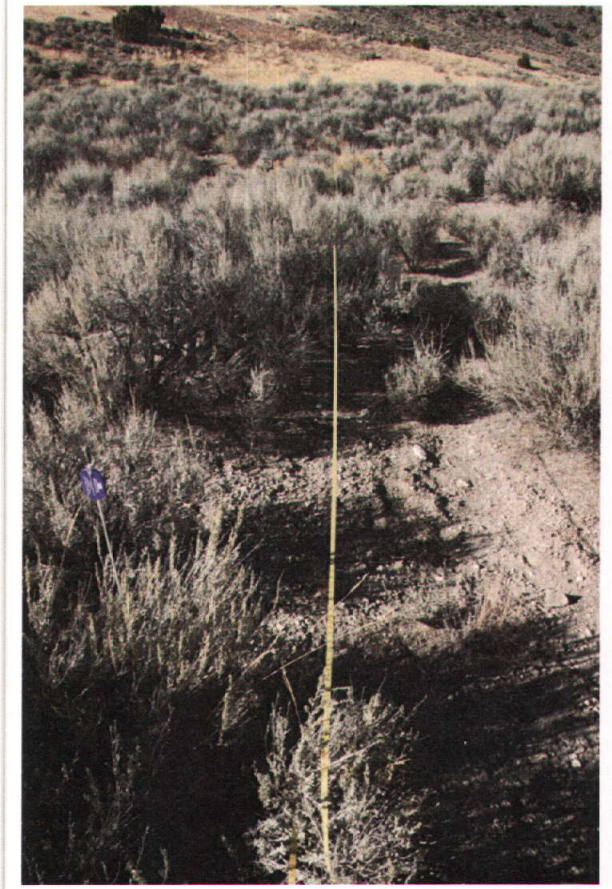
Principal vegetation components include Singleleaf Pinyon (*Pinus monophylla*) and Utah Juniper (*Juniperus osteosperma*).

Minor vegetation components include Cliffrose (*Purshia Mexicana var. stansburyana*), Carpet phlox (*Phlox hoodii*), Beckwith's milkvetch (*Astragalus beckwithii*), Pungent slenderlobe (*Leptodactylodon pungens)*, Nuttall's horsebrush (*Tetradymia nutallii*), Sandberg's bluegrass (*Poa secunda*), and Squirreltail (*Elymus elymoides*).

Other species noted within 3' each side of the transect include *Stellaria species,* Black sagebrush (*Artemisia nova*), Spindlestem (*Caulanthus crassicaulis*), Green Ephedra (*Ephedra viridis)* and Arabis (*Boechera) species.*



Kiewit Mine- Transect KM5- Point A, Photo 5128
View looking south.



Kiewit Mine- Transect KM5- Point B, Photo 5130
View looking north.

Artemisia tridentata var. wyomingensis community

Soil type 4- Amtoft-Rock outcrop complex, 30% to 70% slopes.

Principal vegetation components include Wyoming Big Sagebrush (*Artemisia tridentata var. wyomingensis*), Basin Big Sagebrush (*Artemisia tridentata var. tridentata*) and Cheatgrass (*Bromus tectorum*).

Minor vegetation components include Squirreltail (*Elymus elymoides*), Sandberg's bluegrass (*Poa secunda*), Viscid rabbitbrush (*Chrysothamnus viscidiflorus*), unknown shrub and Opuntia species.

Other species noted within 3' each side of the transect include Green Ephedra (*Ephedra viridis),* Indian Ricegrass (*Stipa hymenoides*), Tumbling mustard (*Sisymbrium altissimum*), *Echium* species, unknown *Brassicaceae* and *Cerastium* species.

Lucy- Transect L1- Point A, Photo 5314
View looking north.

Lucy- Transect L1- Point B, Photo 5315
View looking south.

Black Sagebrush Community

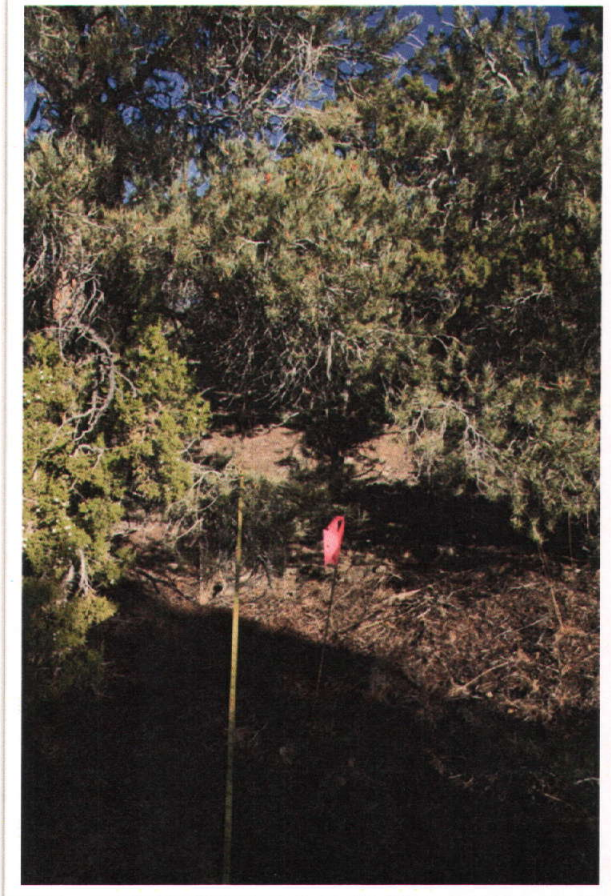
Soil type 4- Amtoft-Rock outcrop complex, 30% to 70% slopes.
Soil type 48- Reywat-Broad-Rock outcrop association, 30 to 60 percent slopes.

Principal vegetation components include Black sagebrush (*Artemisia nova*) and Goldenweed (*Haplopappus nanus).*

Minor vegetation components include Sandberg's bluegrass (*Poa secunda*), Cheatgrass (*Bromus tectorum*), Unknown grass, *Chenopodiaceae* species and Green Ephedra (*Ephedra viridis).*

Other species noted within 3' each side of the transect include *Apiaceae* species, Carpet phlox (*Phlox hoodii*), Squirreltail (*Elymus elymoides*), Viscid rabbitbrush (*Chrysothamnus viscidiflorus*) and Singleleaf Pinyon (*Pinus monophylla*) seedling.

Lucy- Transect L2- Point A, Photo 5318
View looking west.



Lucy- Transect L2- Point B, Photo 5319
View looking east.

Pinyon/Juniper Community

Soil type 48- Reywat-Broad-Rock outcrop association, 30 to 60 percent slopes.

Principal vegetation components include Singleleaf Pinyon (*Pinus monophylla*), Utah Juniper (*Juniperus osteosperma*) and Sandberg's bluegrass (*Poa secunda*).

Minor vegetation components include Carpet phlox (*Phlox hoodii*) and Black sagebrush (*Artemisia nova*).

Other species noted within 3' each side of the transect include Arabis (*Boechera) species,* Cobweb milkvetch *(Astragalus lentiginosus var. araneosus), Cryptantha* species, Cheatgrass (*Bromus tectorum*), Green Ephedra (*Ephedra viridis) and Polemoniace* species.

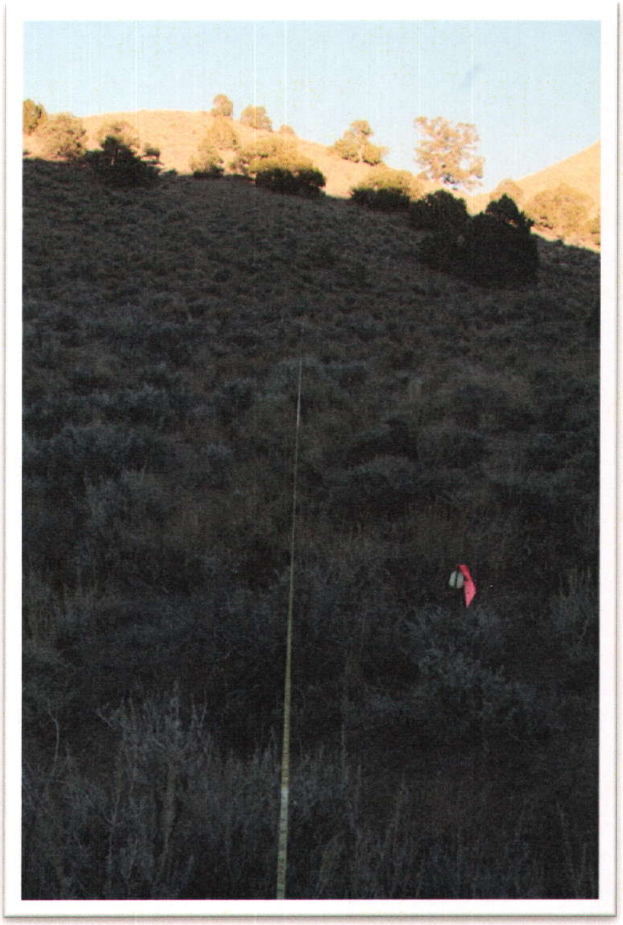
Lucy- Transect L3- Point A, Photo 5320
View looking west.

Black Sagebrush Community

Soil type 48- Reywat-Broad-Rock outcrop association, 30 to 60 percent slopes.

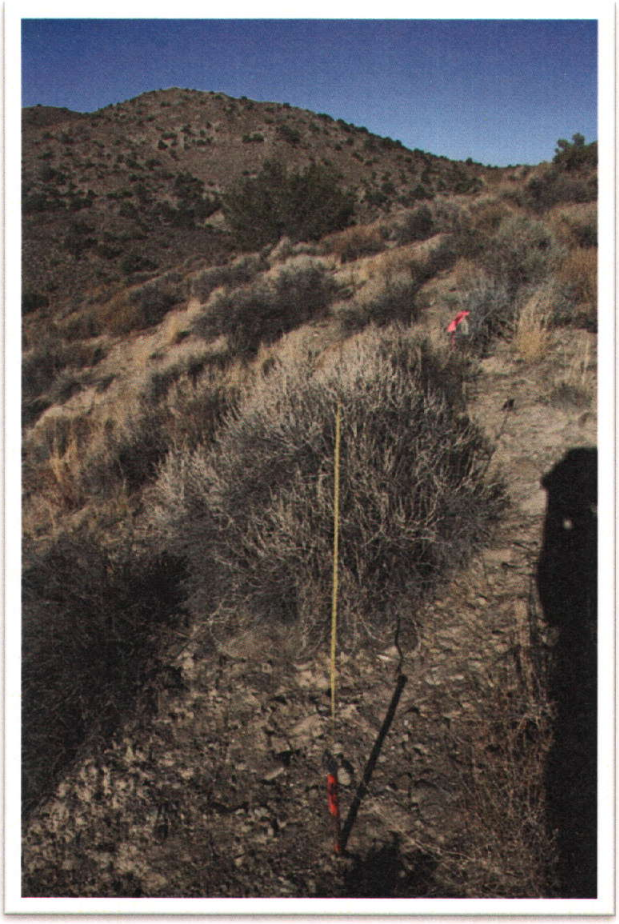
Principal vegetation components include Black sagebrush (*Artemisia nova*), Wyoming Big Sagebrush (*Artemisia tridentata var. wyomingensis*), Hopsage (*Grayia spinosa*) and Sandberg's bluegrass (*Poa secunda*).

Minor vegetation components include Squirreltail (*Elymus elymoides*), Cheatgrass (*Bromus tectorum*), Indian Ricegrass (*Stipa hymenoides*) and Viscid rabbitbrush (*Chrysothamnus viscidiflorus*).

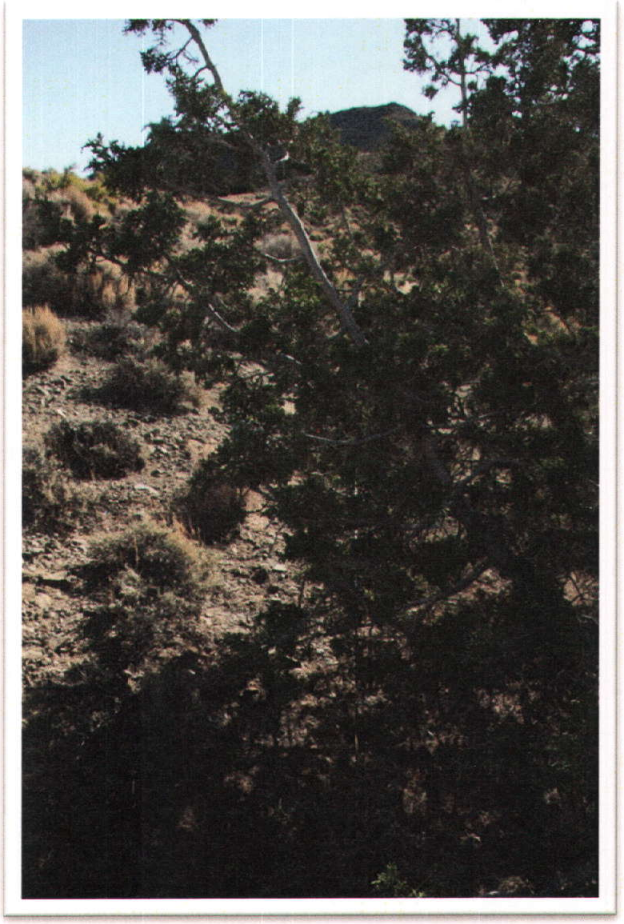


Lucy- Transect L3- Point B, Photo 5323
View looking east.

Other species noted within 3' each side of the transect include Arabis (*Boechera) species,* Needle-and-thread grass (*Stipa comata*) and Utah Juniper (*Juniperus osteosperma*) seedling.



Lucy- Transect L4- Point A, Photo 5338
View looking west.

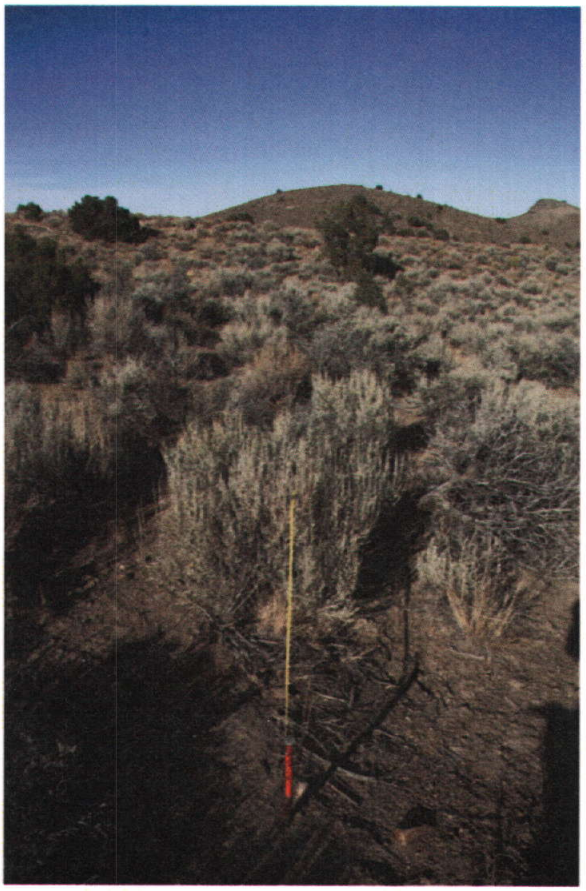


Lucy- Transect L4- Point B, Photo 5339
View looking east.

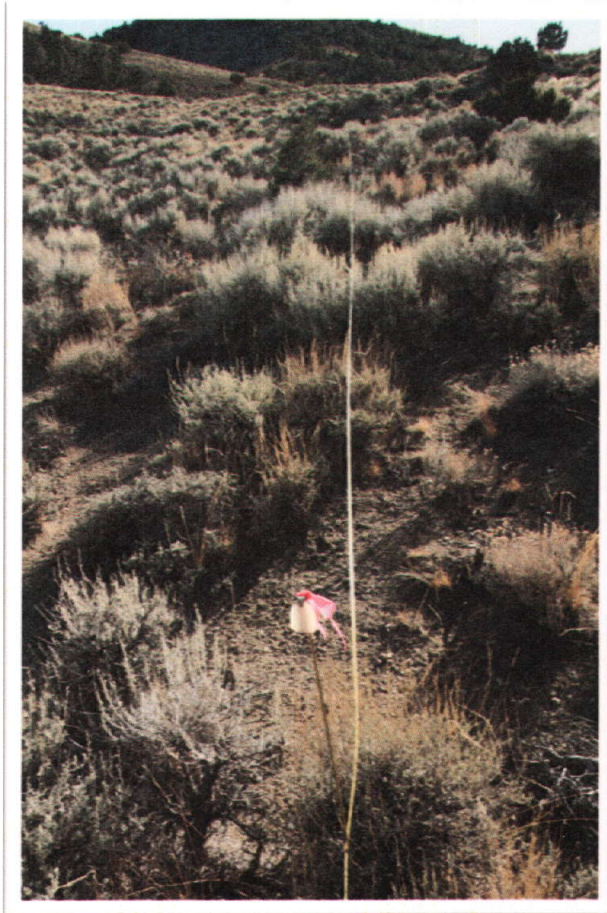
Black Sagebrush Community

Soil type 4- Amtoft-Rock outcrop complex, 30% to 70% slopes.
Principal vegetation components include Black sagebrush (*Artemisia nova*) and Littleleaf horsebrush (*Tetradymia glabrata*).
Minor vegetation components include Beckwith's milkvetch (*Astragalus beckwithii*), Halogeton (*Halogeton glomerata*), Squirreltail (*Elymus elymoides*), Indian Ricegrass (*Stipa hymenoides*), Green Ephedra (*Ephedra viridis),* Hopsage (*Grayia spinosa*), Shadscale (*Atriplex confertifolia),* Viscid rabbitbrush (*Chrysothamnus viscidiflorus*) and Utah Juniper (*Juniperus osteosperma*).

Other species noted within 3' each side of the transect include Squirreltail (*Elymus elymoides*), Tr *Arabis* (*Boechera) species,* Crenulate Phacelia (*Phacelia crenulata),* Rubber Rabbitbrush (*Chrysothamnus naseosus),* Needle-and-thread grass (*Stipa comata*), Unknown forb and Wire lettuce (*Stephanomeria pauciflora).*



North Area- Transect N1- Point A, Photo 5215
View looking north east.



North Area- Transect N1- Point B, Photo 5216
View looking south west.

Wyoming Big Sage Community

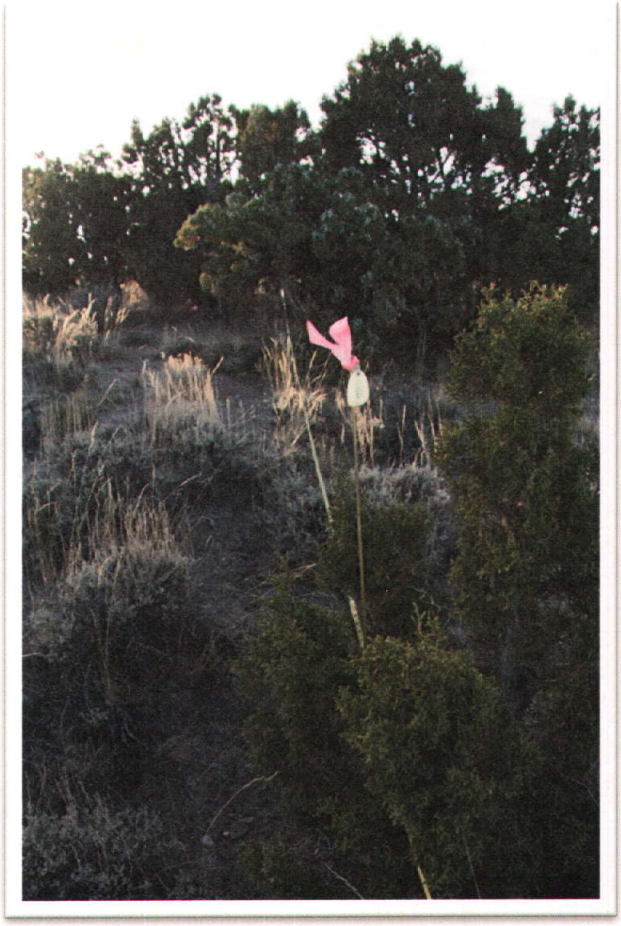
Soil type 48- Reywat-Broad-Rock outcrop association, 30 to 60 percent slopes.

Principal vegetation components include Wyoming Big Sagebrush (*Artemisia tridentata var. wyomingensis*), Black sagebrush (*Artemisia nova*) and Squirreltail (*Elymus elymoides*).

Minor vegetation components include Sandberg's bluegrass (*Poa secunda*), Cheatgrass (*Bromus tectorum*), Indian Ricegrass (*Stipa hymenoides*) and Green Ephedra (*Ephedra viridis).*

Other species noted within 3' each side of the transect include Viscid rabbitbrush (*Chrysothamnus viscidiflorus*), *Opuntia* species, Singleleaf Pinyon (*Pinus monophylla*) and Snowberry (*Symphoricarpos longiflorus).*

North Area- Transect N2- Point A, Photo 5218
View looking south east.



North Area- Transect N2- Point B, Photo 5219
View looking north west.

Pinyon/Juniper Community

Soil type 48- Reywat-Broad-Rock outcrop association, 30 to 60 percent slopes.

Principal vegetation components include Utah Juniper (*Juniperus osteosperma*), Sandberg's bluegrass (*Poa secunda*) and Black sagebrush (*Artemisia nova*).

Minor vegetation components include Squirreltail (*Elymus elymoides*), Indian Ricegrass (*Stipa hymenoides*), Needle-and-thread grass (*Stipa comata*), Hopsage (*Grayia spinosa*) and Viscid rabbitbrush (*Chrysothamnus viscidiflorus*).

Other species noted within 3' each side of the transect include Utah Astragalus (*Astragalus utahensis),* Matt Eriogonum (*Eriogonum* species), Spindlestem (*Caulanthus crassicaulis*) and Singleleaf Pinyon (*Pinus monophylla*) seedlings.

North Area- Transect N3- Point A, Photo 5226
View looking east.

North Area- Transect N3- Point B, Photo 5227
View looking west.

Black Sagebrush Community

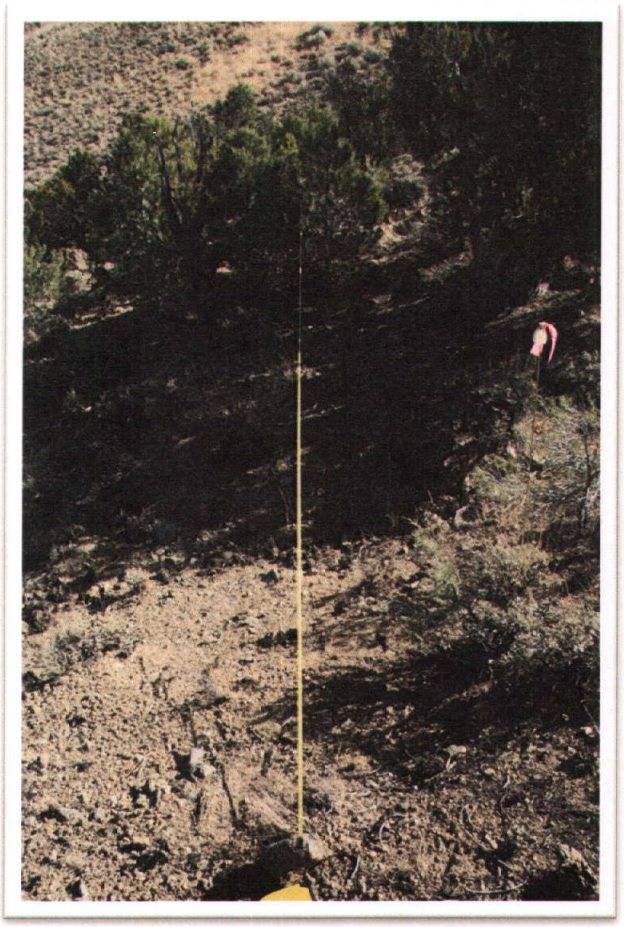
Soil type 48- Reywat-Broad-Rock outcrop association, 30 to 60 percent slopes.

Principal vegetation component is Black sagebrush (*Artemisia nova*).

Minor vegetation components include Carpet phlox (*Phlox hoodii*), Sandberg's bluegrass (*Poa secunda*), Indian Ricegrass (*Stipa hymenoides*) and Viscid rabbitbrush (*Chrysothamnus viscidiflorus*).

Other species noted within 3' each side of the transect include Green Ephedra (*Ephedra viridis), Antennaria* species, *Liliaceae* species, *Erigeron* species and *Opuntia* species.

Rustler- Transect R1- Point A, Photo 5303
View looking south west.



Rustler- Transect R1- Point B, Photo 5300
View looking north east.

Pinyon/Juniper Community

Soil type 4- Amtoft-Rock outcrop complex, 30% to 70% slopes.

Principal vegetation components include Singleleaf Pinyon (*Pinus monophylla*), Utah Juniper (*Juniperus osteosperma*) and Black sagebrush (*Artemisia nova*).

Minor vegetation components include Sandberg's bluegrass (*Poa secunda*), Bluebunch wheatgrass (*Elymus spicatus*), Cheatgrass (*Bromus tectorum*) and *Arabis* (*Boechera) species.*

Other species noted within 3' each side of the transect include *Stellaria species,* Green Ephedra (*Ephedra viridis),* Carpet phlox (*Phlox hoodii*), Beckwith's milkvetch (*Astragalus beckwithii*), Silvery aster (*Macheranthera canescens) and,* Indian Ricegrass (*Stipa hymenoides*).

Rustler-Transect R2- Point A, Photo 5304
View looking west north west.

Rustler-Transect R2- Point B, Photo 5305
View looking east south east.

Black Sagebrush Community

Soil type 4- Amtoft-Rock outcrop complex, 30% to 70% slopes.

Principal vegetation components include Black sagebrush (*Artemisia nova*), Hopsage (*Grayia spinosa*) and Cheatgrass (*Bromus tectorum*).

Minor vegetation components include Squirreltail (*Elymus elymoides*), Galleta (*Hilaria jamesii*), Indian Ricegrass (*Stipa hymenoides*), Unknown grass, *Chenopodiaceae* species , Green Ephedra (*Ephedra viridis) and* Viscid rabbitbrush (*Chrysothamnus viscidiflorus*).

Other species noted within 3' each side of the transect include Bluebunch wheatgrass (*Elymus spicatus*) and *Astragalus* species.

Rustler- Transect R3- Point A, Photo 5308
View looking west.

Rustler- Transect R3- Point B, Photo 5309
View looking east.

Wyoming Big Sagebrush Community

Soil type 4- Amtoft-Rock outcrop complex, 30% to 70% slopes.
Principal vegetation components include Wyoming Big Sagebrush (*Artemisia tridentata var. wyomingensis*), Black sagebrush (*Artemisia nova*) and Sandberg's bluegrass (*Poa secunda*).
Minor vegetation components include Squirreltail (*Elymus elymoides*), Indian Ricegrass (*Stipa hymenoides*), Bluebunch wheatgrass (*Elymus spicatus*), Unknown grass, Hopsage (*Grayia spinosa*), Spindlestem (*Caulanthus crassicaulis*), Viscid rabbitbrush (*Chrysothamnus viscidiflorus*) and Green Ephedra (*Ephedra viridis).*

Other species noted within 3' each side of the transect include Singleleaf Pinyon (*Pinus monophylla*), Beckwith's milkvetch (*Astragalus beckwithii*) and *Arabis* (*Boechera) species.*

Yellow Hammer- Transect YH1- Point A, Photo 5157

View looking south west.

Black Sagebrush Community

Soil type 4- Amtoft-Rock outcrop complex, 30% to 70% slopes.

Principal vegetation components include Black sagebrush (*Artemisia nova*), Wyoming Big Sagebrush (*Artemisia tridentata var. wyomingensis*), Sandberg's bluegrass (*Poa secunda*) and Squirreltail (*Elymus elymoides*).

Minor vegetation components include Shadscale (*Atriplex confertifolia),* Cheatgrass (*Bromus tectorum*) and an unidentifiable forb.

Yellow Hammer- Transect YH1- Point B, Photo 5158

View looking north east.

Other species noted within 3' each side of the transect include Viscid rabbitbrush (*Chrysothamnus viscidiflorus*), *Opuntia* species, Carpet phlox (*Phlox hoodii*), Arabis (*Boechera) species* and Singleleaf Pinyon (*Pinus monophylla*) seedlings.

Yellow Hammer- Transect YH2- Point A, Photo 5164
View looking east.

Yellow Hammer- Transect YH2- Point B, Photo 5165
View looking west.

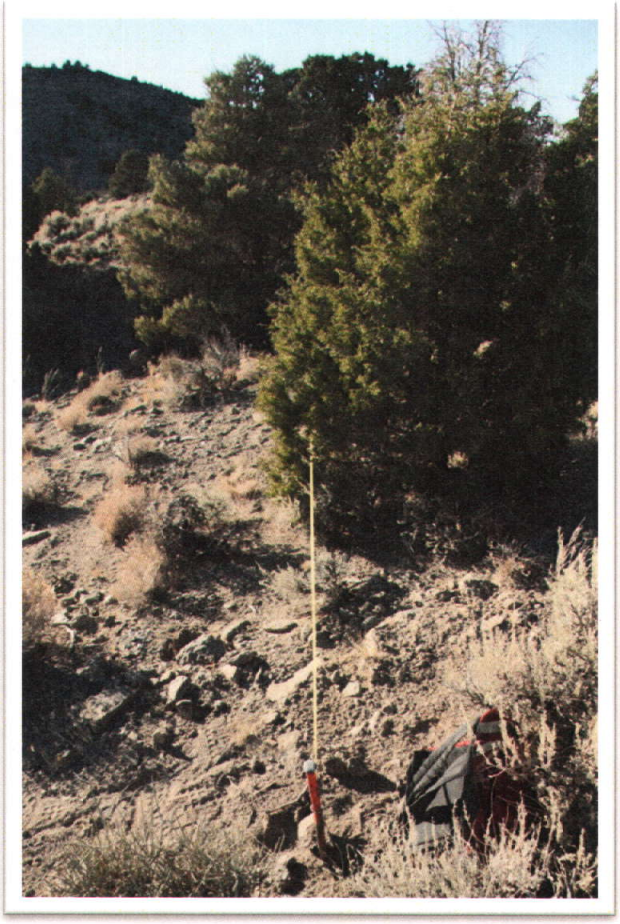
Wyoming Sagebrush Community

Soil type 48- Reywat-Broad-Rock outcrop association, 30 to 60 percent slopes.

Principal vegetation components include Wyoming Big Sagebrush (*Artemisia tridentata var. wyomingensis*), Sandberg's bluegrass (*Poa secunda*) and Squirreltail (*Elymus elymoides*).

Minor vegetation components include Viscid rabbitbrush (*Chrysothamnus viscidiflorus*), Singleleaf Pinyon (*Pinus monophylla*) seedling, Indian Ricegrass (*Stipa hymenoides*) and Needle-and-thread grass (*Stipa comata*).

Other species noted within 3' each side of the transect include Cheatgrass (*Bromus tectorum*), Beckwith's milkvetch (*Astragalus beckwithii*) and *Phlox* species.



Yellow Hammer- Transect YH3- Point A, Photo 5166
View looking north west.

Yellow Hammer- Transect YH3- Point B, Photo 5167
View looking south east.

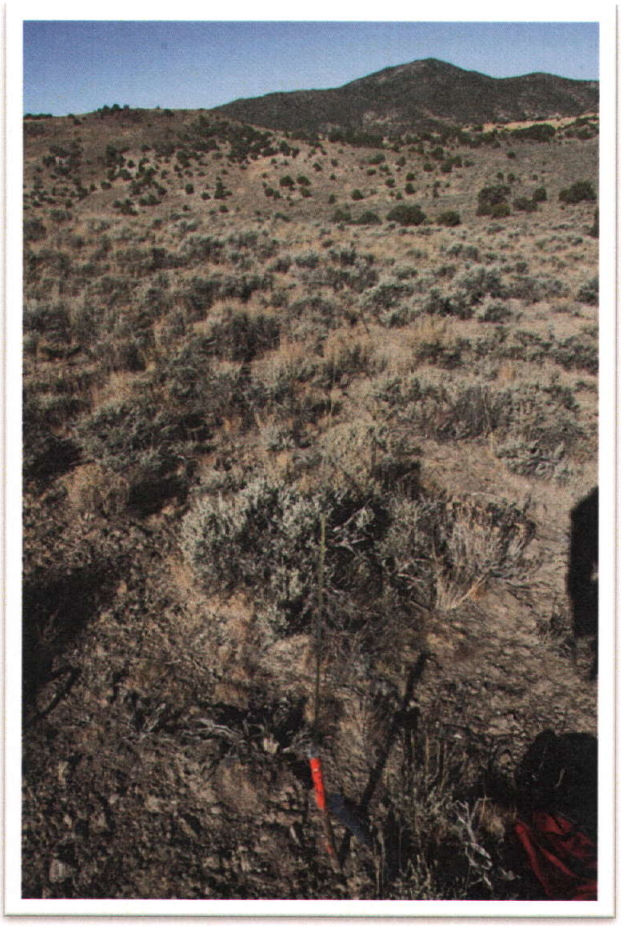
Pinyon/Juniper Community

Soil type 48- Reywat-Broad-Rock outcrop association, 30 to 60 percent slopes.

Principal vegetation components include Singleleaf Pinyon (*Pinus monophylla*) , Utah Juniper (*Juniperus osteosperma*), Wyoming Big Sagebrush (*Artemisia tridentata var. wyomingensis*) and Black sagebrush (*Artemisia nova*).

Minor vegetation components include Sandberg's bluegrass (*Poa secunda*), Squirreltail (*Elymus elymoides*), Cheatgrass (*Bromus tectorum*), Indian Ricegrass (*Stipa hymenoides*), Viscid rabbitbrush (*Chrysothamnus viscidiflorus*) and Hopsage (*Grayia spinosa*).

Other species noted within 3' each side of the transect include Green Ephedra (*Ephedra viridis),* Carpet phlox (*Phlox hoodii*) and Needle-and-thread grass (*Stipa comata*).



Yellow Hammer- Transect YH4- Point A, Photo 5202
View looking west.

Yellow Hammer- Transect YH4- Point B, Photo 5203
View looking east.

Black Sagebrush Community

Soil type 48- Reywat-Broad-Rock outcrop association, 30 to 60 percent slopes.

Principal vegetation components include Black sagebrush (*Artemisia nova*), Wyoming Big Sagebrush (*Artemisia tridentata var. wyomingensis*) and Sandberg's bluegrass (*Poa secunda*).

Minor vegetation components include Carpet phlox (*Phlox hoodii*), *Astragalus* species , Squirreltail (*Elymus elymoides*), unidentifiable forbs, Viscid rabbitbrush (*Chrysothamnus viscidiflorus*), Hopsage (*Grayia spinosa*) and Shadscale (*Atriplex confertifolia).*

Other species noted within 3' each side of the transect include Spindlestem (*Caulanthus crassicaulis*), *Opuntia* species, Tumbling mustard (*Sisymbrium altissimum*), *Liliaceae* species, Utah Astragalus (*Astragalus utahensis), Erigeron* species and (*Phlox longifolia)*

Yellow Hammer- Transect YH5- Point A, Photo 5207
View looking north east.

Pinyon/Juniper Community

Soil type 48- Reywat-Broad-Rock outcrop association, 30 to 60 percent slopes.

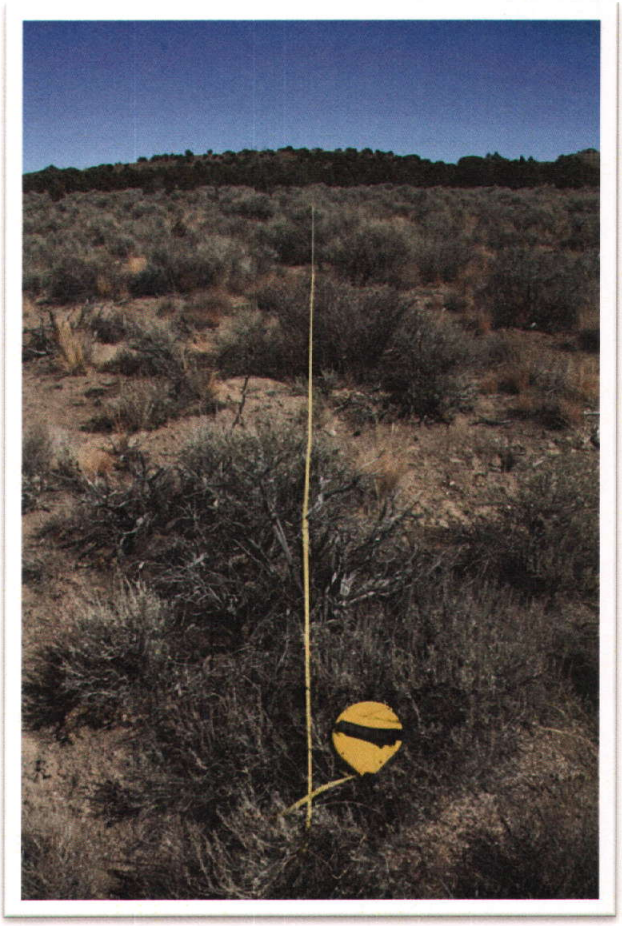
Principal vegetation components include Singleleaf Pinyon (*Pinus monophylla*) and Utah Juniper (*Juniperus osteosperma*).

Minor vegetation components include Sandberg's bluegrass (*Poa secunda*), and Squirreltail (*Elymus elymoides*), Cheatgrass (*Bromus tectorum*), Indian Ricegrass (*Stipa hymenoides*), *Astragalus* species, *Boraginaceae* species, Longleaf Phlox (*Phlox longifolia), Castilleja* species, Viscid rabbitbrush (*Chrysothamnus viscidiflorus*), Green Ephedra (*Ephedra viridis),* Wyoming Big Sagebrush (*Artemisia tridentata var. wyomingensis*), Black sagebrush (*Artemisia nova*) and Hopsage (*Grayia spinosa*).

Yellow Hammer- Transect YH5- Point B, Photo 5210
View looking south west.

Other species noted within 3' each side of the transect include Spindlestem (*Caulanthus crassicaulis*), Needle-and-thread grass (*Stipa comata*) and *Liliaceae* species.

Yellow Hammer- Transect YH6- Point A, Photo 5211
View looking west north west.



Yellow Hammer- Transect YH6- Point B, Photo 5212
View looking east south east.

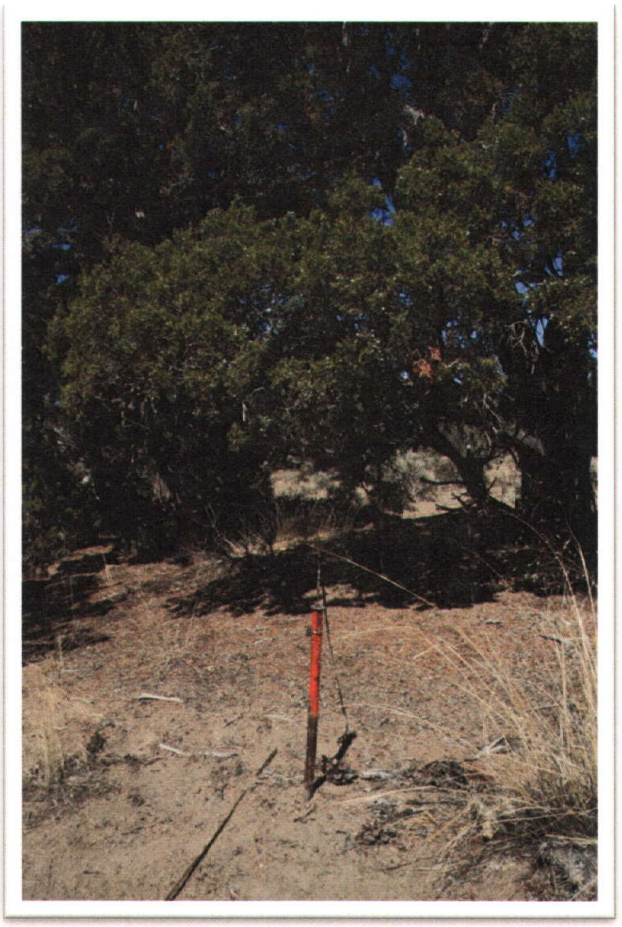
Wyoming Sagebrush Community

Soil type 48- Reywat-Broad-Rock outcrop association, 30 to 60 percent slopes.

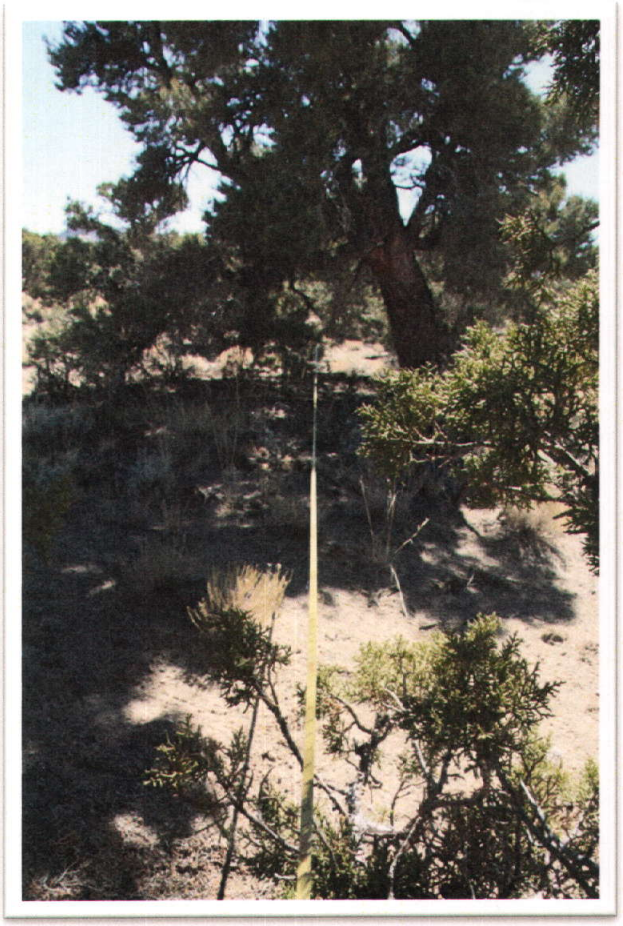
Principal vegetation components include Wyoming Big Sagebrush (*Artemisia tridentata var. wyomingensis*), Viscid rabbitbrush (*Chrysothamnus viscidiflorus*), Hopsage (*Grayia spinosa*) and Squirreltail (*Elymus elymoides*).

Minor vegetation components include Sandberg's bluegrass (*Poa secunda*), Cheatgrass (*Bromus tectorum*), Indian Ricegrass (*Stipa hymenoides*), Carpet phlox (*Phlox hoodii*), Longleaf Phlox (*Phlox longifolia)* and *Opuntia* species.

Other species noted within 3' each side of the transect include *Astragalus* species, Arabis (*Boechera) species, Liliaceae* species, *Delphinium* species, Needle-and-thread grass (*Stipa comata*) and Great Basin Wildrye (*Elymus cinereus).*



Yellow Hammer- Transect YH7- Point A, Photo 5213
View looking north.



Yellow Hammer- Transect YH7- Point B, Photo 5214
View looking south.

Pinyon/Juniper Community

Soil type 48- Reywat-Broad-Rock outcrop association, 30 to 60 percent slopes.

Principal vegetation components include Singleleaf Pinyon (*Pinus monophylla*) , Utah Juniper (*Juniperus osteosperma*) and Sandberg's bluegrass (*Poa secunda*).

Minor vegetation components include Squirreltail (*Elymus elymoides*), Cheatgrass (*Bromus tectorum*), Indian Ricegrass (*Stipa hymenoides*), *Opuntia* species, Wyoming Big Sagebrush (*Artemisia tridentata var. wyomingensis*) and Viscid rabbitbrush (*Chrysothamnus viscidiflorus*).

Other species noted within 3' each side of the transect include Needle-and-thread grass (*Stipa comata*), Carpet phlox (*Phlox hoodii*), Shadscale (*Atriplex confertifolia),* Nuttall's horsebrush (*Tetradymia nutallii*) and *Antennaria* species.

Frankie- Transect F3- Point A, Photo 5361
View looking east north east.

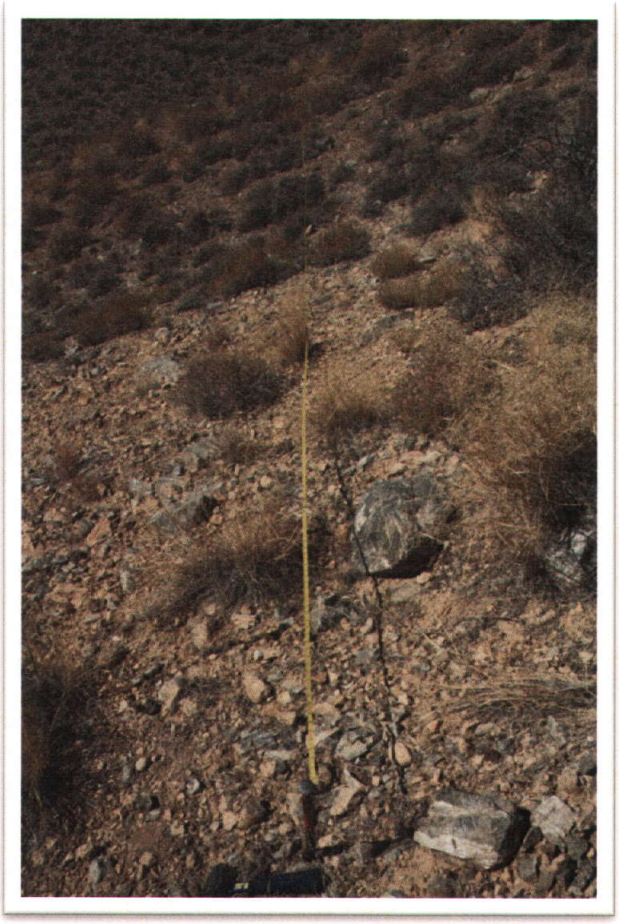
Frankie- Transect F3- Point B, Photo 5362
View looking west south west.

Wyoming Big Sagebrush Community

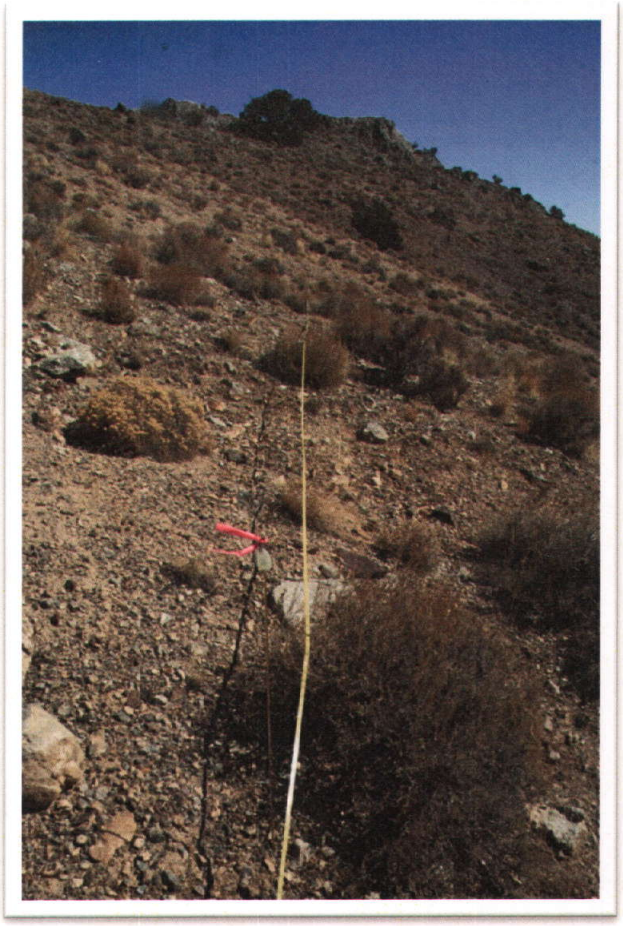
Soil type 4- Amtoft-Rock outcrop complex, 30% to 70% slopes.

Principal vegetation components include Wyoming Big Sagebrush (*Artemisia tridentata var. wyomingensis*), Hopsage (*Grayia spinosa*) and Squirreltail (*Elymus elymoides*).
Minor vegetation components include Sandberg's bluegrass (*Poa secunda*), Bluebunch wheatgrass (*Elymus spicatus*), Cheatgrass (*Bromus tectorum*), Carpet phlox (*Phlox hoodii*), unknown forb, Black sagebrush (*Artemisia nova*) and Singleleaf Pinyon (*Pinus monophylla*).

Other species noted within 3' each side of the transect include Viscid rabbitbrush (*Chrysothamnus viscidiflorus*), Shadscale (*Atriplex confertifolia), Arabis (Boechera) species, Erigeron* species, Indian Ricegrass (*Stipa hymenoides*) and Gray Molly (*Bassia americana*).



Frankie- Transect F1- Point A, Photo 5352
View looking west south west.



Frankie- Transect F1- Point B, Photo 5353
View looking east north east.

Black Sagebrush Community

Soil type 4- Amtoft-Rock outcrop complex, 30% to 70% slopes.

Principal vegetation components include Black sagebrush (*Artemisia nova*) and Indian Ricegrass (*Stipa hymenoides*).

Minor vegetation components include Squirreltail (*Elymus elymoides*), Bluebunch wheatgrass (*Elymus spicatus*), Needle-and-thread grass (*Stipa comata*), Galleta (*Hilaria jamesii*), unknown grass, *Atriplex* species, Gray Molly (*Bassia americana*) and Shadscale (*Atriplex confertifolia).*

Other species noted within 3' each side of the transect include Green Ephedra (*Ephedra viridis),* Viscid rabbitbrush (*Chrysothamnus viscidiflorus*), Nuttall's horsebrush (*Tetradymia nuttallii),* Shadscale (*Atriplex confertifolia),* Cheatgrass (*Bromus tectorum*) and Musk thistle *(Carduus nutans).*

Frankie-Transect F2- Point A, Photo 5356
View looking north.

Frankie-Transect F2- - Point B, Photo 5357
View looking south.

Black Sagebrush Community

Soil type 4- Amtoft-Rock outcrop complex, 30% to 70% slopes.

Principal vegetation is Black Sagebrush (*Artemisia nova*).

Minor vegetation components include Sandberg's bluegrass (*Poa secunda*), unknown grass, Cheatgrass (*Bromus tectorum*), Hopsage (*Grayia spinosa*), Shadscale (*Atriplex confertifolia),* Viscid rabbitbrush (*Chrysothamnus viscidiflorus*) and Singleleaf Pinyon (*Pinus monophylla*) seedling.

Other species noted within 3' each side of the transect include *Castilleja* species, *Chenopodiaceae* species, Matt Eriogonum (*Eriogonum* species), Longleaf Phlox (*Phlox longifolia),* Nuttall's horsebrush (*Tetradymia nuttallii)* and Indian Ricegrass (*Stipa hymenoides*).

Cactus Mill Transect CM2- Point A, Photo 5108
View looking south west.

Cactus Mill Transect CM2- Point B, Photo 5109
View looking north east.

Soil type 4- Amtoft- Rock outcrop complex, 30% to 70% slopes.

Common vegetation components include Black sagebrush (*Artemisia nova*), Viscid rabbitbrush (*Chrysothamnus viscidiflorus*), and Littleleaf horsebrush (*Tetradymia glabrata*).

Minor vegetation components include Shadscale (*Atriplex confertifolia)*, Indian Ricegrass (*Stipa hymenoides*), Sandberg's bluegrass (*Poa secunda*), and Needle-and-thread grass (*Stipa comata*).

Other species present within 3' each way of the transect include Prince's plume (*Stanleya pinnata*), Tumbling mustard (*Sisymbrium altissimum*), African mustard (*Malcolmia africana*), and Carpet phlox (*Phlox hoodii*).

Cactus Mill Transect CM3- Point A, Photo 5110
View looking east.

Soil type 4- Amtoft- Rock outcrop complex, 30% to 70% slopes.

Common vegetation components include Wyoming Big Sagebrush (*Artemisia tridentata var. wyomingensis*), Greasewood (Sarcobatus vermiculatus), Viscid rabbitbrush (*Chrysothamnus viscidiflorus*), and Halogeton (*Halogeton glomerata*).

Minor vegetation components include Green Ephedra (*Ephedra viridis)* and Shadscale (*Atriplex confertifolia)*.

Cactus Mill Transect CM3- Point B, Photo 5111
View looking west.

Other species present within 3' each side of the transect include Littleleaf horsebrush (*Tetradymia glabrata*), Tumbling mustard (*Sisymbrium altissimum*), Galleta (*Hilaria jamesii*), Nuttall's horsebrush (*Tetradymia nutallii*), Carpet phlox (*Phlox hoodii*), Gray Molly (*Bassia americana*) and Bluebunch wheatgrass (*Elymus spicatus*).

Cactus Mill Transect CM4- Point A, Photo 5113
View looking east north east.

Cactus Mill Transect CM4- Point B, Photo 5114
View looking west south west.

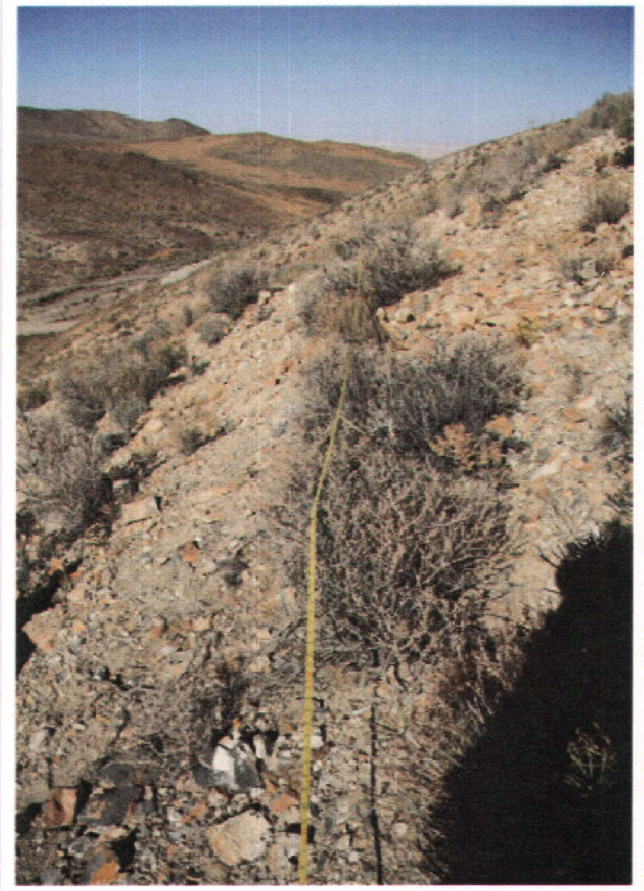
Soil Type 11: Checkett- Very cobbly loam, 10% to 40% slopes.

Common vegetation components include Greasewood (*Sarcobatus vermiculatus*), Green Ephedra (*Ephedra viridis*), Galleta grass (*Hilaria jamesii*), Indian Ricegrass (*Stipa hymenoides*), and Halogeton (*Halogeton glomeratus*).

Minor vegetation components include Big Sagebrush (*Artemisia tridentata var. tridentata*), Shadscale (*Atriplex confertifolia*) and Crenulate Phacelia (*Phacelia crenulata*).

Other species present within 3' each side of the transect include Tumbling Mustard (*Sisymbrium altissimum*), and Cheatgrass (*Bromus tectorum*).

Cactus Mill Transect CM1- Point A, Photo 5106
View looking south west.



Cactus Mill Transect CM1- Point B, Photo 5107
View looking north east.

Soil type 4- Amtoft-Rock outcrop complex, 30% to 70% slopes.

Common vegetation components include Nuttall's horsebrush (*Tetradymia nutallii*) and Black sagebrush (*Artemisia nova*).

Minor vegetation components include Viscid rabbitbrush (*Chrysothamnus viscidiflorus*), Shadscale (*Atriplex confertifolia)*, Sandberg's bluegrass (*Poa secunda*), Squirreltail (*Elymus elymoides*), Carpet phlox (*Phlox hoodii*).

Other species present within 3' of the transects are Green Ephedra (*Ephedra viridis)*, Indian Ricegrass (*Stipa hymenoides*), Prince's plume (*Stanleya pinnata*), Matt Eriogonum (*Eriogonum* species) and Broom snakeweed (Gutierrezia sarothrae).